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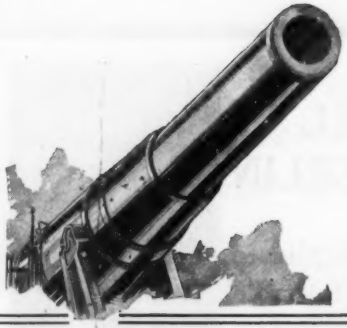

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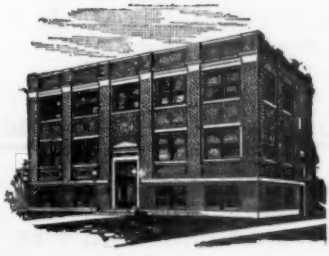

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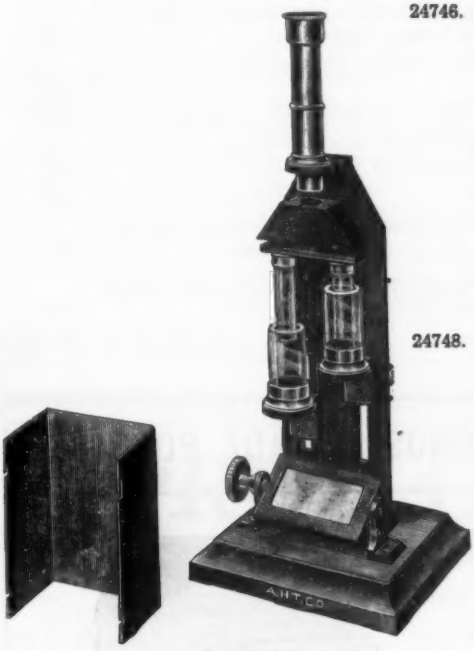

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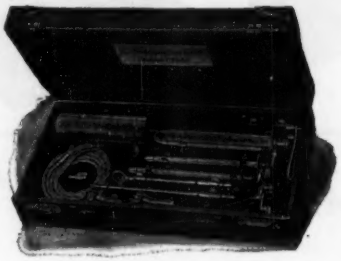

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ORIGINAL ARTICLES

ONE ASPECT OF SYPHILIS AS A COMMUNITY PROBLEM.

By H. S. Newcomer, M.D., Russell Richardson, M.D.,

and

Charlotte Ashbrook,

(From the Pennsylvania Hospital, Philadelphia.)

With an Introduction by

Paul A. Lewis, M.D.,

of the Henry Phipps Institute of the University of Pennsylvania.

Introduction (Lewis). Syphilis was recognized by the older of the present-day physicians as being a most frequent and important deleterious factor in the health of the community. Witness Osler's sentence with reference to the general diagnosis of the disease: "It is to be remembered that syphilis is common in the community, and there are probably more families with a luetic than with a tubercular taint." Unfortunately, the more precise studies of recent years have only served to emphasize the truth of this belief.

Vedder gives a careful review of the results of many "Wassermann surveys." He reaches the conclusion that, making due allowance for the failure of the reaction to detect many cases of latent syphilis, probably 15 per cent. of the population are tainted with disease. No attempt to arrive at a universal or blanket figure can be altogether acceptable, but this estimate is probably as fair as can be. Certainly, an estimate of 10 per cent. would be conservative.

More tangible are the results of the study of particular groups among the population. Dr. Davies, at my suggestion, made

Wassermann tests on about 250 persons as they came into the receiving ward of the Pennsylvania Hospital. The persons were not selected; that is, the blood was taken without reference to any other symptom of syphilis. The result showed that about 10 per cent. gave positive reactions. In other words, more than 10 per cent. of all persons presenting themselves to a general hospital for treatment are either there because of syphilis or their illness is complicated by a coexistent syphilis. Dr. Davies also examined 218 cases presenting themselves in the dispensary of the Phipps Institute without selection; 6.5 per cent. gave positive reactions. Further, Dr. S. T. Orton has supplied me with figures from the Pennsylvania Hospital for the Insane showing that approximately 20 per cent. of the male patients and 6.5 per cent. of the female patients give positive Wassermann tests. The Wassermann test used in this way gives a figure certainly less than the actual, and it may be conservatively stated that 15 per cent. of the work of a representative hospital for the insane has to do either directly or indirectly with syphilis.

When it is stated that the conditions widely known as locomotor ataxia and general paralysis are manifestations of syphilis, such figures as these, drawn from the patients of our general hospitals and our insane hospitals must show clearly to any one, even though untrained in medical science, the mass of pure and now unadorned misery attributable to this disease.[1]

Again, Osler[2] writes: "The State accepts the responsibiliy of guarding citizens against smallpox or cholera, but in dealing with syphilis the problem has been too complex and has hitherto baffled solution." This sentence, written in 1892, may well hold true in very large measure thirty years hence unless the effort at present in progress to revise the attitude of the community toward this disease and the basic social problems related to it come shortly to progress with the speed of an effective revolution.

"A complex problem which has hitherto baffled solution," it has impressed me as being, from the time, some seven years ago, when I first came in practical contact with it. It required then no great acumen to realize that it was no problem whose solution could be covered by any simple formula. "Segregation of Prostitutes," "Education of the Public," "Vaccination" (supposing it possible) "Prophylactic Therepeutics," "Enforced Reporting," are, of course, catch phrases, each representing an idea valuable in its time and place, but neither singly nor together capable of solving the problem in other than the idealistic sense. Neither is it a prob-

[1] To those interested in the subject of this paper the recent monographs of Vedder (Syphilis and Public Health) and Stokes (The Third Great Plague) are recommended. They present a general view when at most we emphasize certain details by drawing on our personal experience.

[2] Practice of Medicine, 1892.

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lem for any particular class of specialists in the community, the policeman or the lawyer, the minister or the social worker. Least of all today is it the problem peculiar to the doctor, for the medical problems involved are nearly enough solved for all practical purposes. It is implied by Osler, as quoted above, that it is properly and primarily a problem which is to be solved by developing the responsibility of the "State" for the protection of the citizens (extension of police power), and of recent years certain States of our country have placed rigorous laws on the statute books in recognition of demands of this nature. It is probably fair to believe, however, that the direct preventive value of such police measures is slight and their educational value considerable—as good an illustration as could be constructed of the baffling nature of the problem.

Certainly, then, one can never look forward to any solution of this problem that can be covered by a purely technical formula, whether legal or medical or social in its make-up. Nor does the work of my colleagues in this presentation even hint at any such general solution.

If syphilis is to be eradicated there will be required the combined efforts of all the specialists concerned—educators, physicians, police and sociologists, as the case may be—using their special skill to its fullest powers. More than that, however, a new attitude must be developed toward the situation by all involved in it. Facts must be considered before moral concepts. Sympathy must be substituted for stigma. The forcible but cold idea of "State" responsibility and control must give way to a sincere interest in community welfare. Above all, no dogma that this or that measure will not work (or will do all) is to be accepted. Every reasonable suggestion must be tried —tried often under most discouraging conditions—but not discarded until incontrovertible facts demand it. It is in this light that the following report seems to me to be of real value. An attempt has been made to combine human sympathy and decency in the honest management of individual cases, with the precise methods of scientific study which alone can, in the end, decide as to the usefulness of particular methods of work. Certain of the results encourage the belief that progress is being made, and suggest that the methods employed might well be tentatively adopted by others.

The intimate history of the development of the present clinic for syphilis at the Pennsylvania Hospital contains much that seems to be instructive, throwing light, as it does, on the chaos which prevails in the public consideration of the problem. In 1911 I became connected with the Pennsylvania Hospital as the director of the Ayer Clinical Laboratory. Salvarsan had rather recently (1909–10) been introduced to the medical profession as a remedy for syphilis, from which much was expected. My predecessor in charge of the laboratory (Dr. Warfield Longcope) had completed the careful study of a number of cases of a particular type of heart

disease (aortic regurgitation), had fully confirmed a growing belief that these cases were syphilitic in origin and had administered salvarsan to a number of them for a considerable period. The use of this drug was spreading gradually to other types of syphilitic disease in the hands of other physicians on the staff of the hospital. Because of technical difficulties the preparation of the solution for injection had, necessarily, been carried out in the laboratory rather than in the drug store (of the hospital), and it had also become customary to call on Dr. Longcope and his assistants of the laboratory staff to administer the drug. This work was transmitted to my staff as a legacy.

It impressed me strongly in the beginning that this was no proper work for the laboratory and I made every effort to transfer it to the clinical services, where I thought it properly belonged. A ruling was secured from the staff that salvarsan was to be administered by the resident physicians under the direction of the chief resident. The laboratory undertook to instruct one or more residents in the work in the full expectation that they would transmit their knowledge to their successors, and that we would be relieved of the work. A year or more was gone through on this basis and it was most unsatisfactory. What with an increasing use of the method, repeated calls on the laboratory for administration because the house was overbusy, the necessity of instructing new groups of men as the house staff changed, those departing having failed to instruct their successors; it became apparent that the laboratory staff was giving more time than ever to the injection of the drug. Also the records were scattered and kept according to no uniform system; the cases were treated according to no well-thought-out plan, and altogether much energy was dissipated to no good purpose. In general, in spite of the fact that the administration of salvarsan seemed clearly to be the function of the clinician, it seemed in the practice of this hospital at least to be a definite duty of the laboratory.

When opportunity offered, therefore, steps were taken, based on the recognition of this situation. The ground taken was that it seemed to be most practicable for the laboratory staff to administer salvarsan; also, that it was to the interest of all concerned, particularly for the good of the patients, that whoever administered the drug should be responsible for the complete management of the case during the time it was under this special treatment. The necessity of this arose because it developed that orders might be given and carried out for the administration of a certain dose at a certain time, and it would afterward be discovered that through someone's blunder either the necessary urine and blood examinations had not been called for or mercury had not been stopped (as was then thought advisable), or other mistake had been made through lack of effective supervision. It was therefore agreed that cases regarded by the clinical staff as requiring salvarsan should be referred to the director

of the laboratory for treatment. They were retained in his charge until he felt that salvarsan would accomplish no more, when they were returned to the service from which they came.

It was recognized that the staff of the laboratory was insufficient to enable it to handle the normal increase in the volume of the work, which was clearly foreseen with the growing confidence of physicians in the usefulness of the drug. An additional physician was assigned to the laboratory staff for this and other duties. Dr. Richardson assumed for me the duty of administering salvarsan and took over all contacts with patients. So far the situation had forced the reorganization, and, as was to be expected, under such circumstances no serious difficulty was experienced in carrying the arrangement into effect. The effective feature was the unification of control thus secured, the particular place where responsibility lay being, within reason, an entirely secondary matter. Within reason is used advisedly, and this should be noted particularly.

It is quite unreasonable to have the most important cases of syphilis from the community point of view, that is, the open-active and infectious case in the primary or secondary stage, treated in some out-of-the-way corner by the least thoughtful and most uncouth junior member of the hospital's surgical staff, with little or no supervision or enforced sense of responsibility. This condition has prevailed too long and too often, and one must assume that the professional staff and management of any hospital where this relationship persists not only recognize the prevailing and proper prejudice against this disease as an evidence of immorality, but quite improperly give this prejudice precedence over their clear professional duty to the patient, and particularly to the public health. I regard it, therefore, as perhaps the most important accomplishment of my colleagues, and I include with them in this the management of the Pennsylvania Hospital, that the cases of syphilis are now for the most part seen in consultation and treated in the receiving ward and the adjacent rooms of the main surgical clinic. This change has certainly in no way lessened the repute of the hospital.

At the time these changes were made I had been familiar with the operation of the out-patient clinics of the Henry Phipps Institute, where a modern social service department was active. Such a service when carried on in the proper spirit forms an indispensable bridge between the physician and the patient. It assures a regular and sympathetic contact between the two, that patients present themselves for examination, advice and treatment, and that such treatment as is recommended, whether in the way of drugs or economic adjustment, is actually carried out. At its best and plainly stated the social service makes it possible for the more or less impersonal organization of a hospital to come into those intimately helpful relations with the people, its patients, that is so characteristic a feature of the life and work of the best type of family physician.

Such a department of social service was in successful operation at the hospital at this time in connection with the more general work of the institution. The question arose then naturally as to whether they could successfully assist in the management of syphilis. At the time it appeared to all to be a very serious question, and one the answer to which could not be predicted. Would these patients submit to the questioning, to the advisory activity, to the constant contact in connection with their trouble, often based on immorality, with persons, women, of obvious respectability? In retrospect these questions appear almost laughably childish, based, as they were, upon a complete misconception of the actual humane aspects of the situation. The syphilitic is a sick person, often, if intelligent, a badly frightened and distressed person. He or she welcomes any honest effort to improve matters. Moreover, and more definitely important, perhaps, the youth of today, wild, immoral or unmoral, as one may choose the word, is the man with a family of a year or two hence. And it is but fair to say that the major part of the work of this clinic has, as a matter of fact, been concerned with what may be called a family practice. The unattached professedly or professionally immoral, either male or female, have been in the minority. Such as have come to the clinic have been dealt with in regular course, with no untoward incident, and leave us with no reason to suppose that they are as a class impossible to handle.

In another sense expectation has been agreeably at fault. As the clinic has developed it has become clear that it need not permanently be a large item of expense to the hospital. When starting out there was a large overhead charge proportionately to the number of patients treated, and the effort required and received liberal financial support from the hospital. The principle of charging those who could afford to pay was adopted from the start. Probably a mistake was first made in fixing the basic price too high ($5 per salvarsan treatment). Later the price was dropped to that of the cost of salvarsan, and it has since been gradually increased. The outcome up to the present is summarized at the end of the report. The very favorable result is partly, no doubt, to be accounted for by the high wage scale of the past two years. There seems to be no reason why a good working balance should not be maintained, however, on a falling scale of wages if the salvarsan is lowered to a reasonable figure based on cost of production.

In the future the State should certainly be expected to furnish salvarsan for such as are actually unable to pay for it. With a widespread organization of such clinics in operation the cost of this item to the State should be more than made up in the relief to general and insane hospitals now forced to care for the preventable late manifestations of the disease. With State aid to cover the charge for drugs to the truly poverty-stricken and the unwilling openly infectious cases, the question of cost still presents certain debatable features which require brief mention:

1. Should the hospital compete with the private physician in this field and undercharge him? The usual minimum fee for the administration of salvarsan in this neighborhood by private practitioners among the working class is $25 a dose. The consequence is that treatment, if taken at all, is not persisted in. As there seems to be reason to doubt whether the practitioner treating a small number of such cases can really afford to work for a lower fee, it is clear that the hospital method must prevail in the public interest.

2. How is the charge to be decided upon? It appears to us that the charge should be such as to permit the patient to carry out a systematic course of treatment with a distinctly serious effort, but without hardship detrimental to his other vital interests. The calamity is that he should go untreated. It should not cost so little as to seem trivial nor so much as to be unattainable.

3. Is there any good reason why an expensive treatment (salvarsan) should be substituted for an inexpensive one (mercury). Aside from the purely medical questions involved (the greater efficiency of salvarsan in many cases) it has become evident that the more exacting method (salvarsan) interests the patient much more thoroughly, and this is a large factor in persuading him to persist in the treatment. Moreover, the physician himself administers salvarsan and consequently maintains control of the situation. With mercury the patient's energy and intelligent initiative are severely taxed by the prolonged necessity of drug-taking by methods which are often disagreeable. The salvarsan treatment from the community point of view for these reasons is by far superior to mercury.

From the purely medical point of view the report speaks for itself. It cannot be too often emphasized that cure is possible in the earliest stages, that it very soon becomes problematical and finally extremely doubtful whether cure can be attained. Probably no one can state accurately just when treatment should be stopped after it is recognized that cure cannot be accomplished. In view of the serious nature of the late effects of the disease it is probably always safe to advise a little more treatment on some systematic intermittent plan as a preventive for these.

So much for the encouraging aspects of the work of this clinic. The other side of the picture is presented when the number of early cases presenting themselves for treatment is examined. They are few. How to make them more; how, in other words to reach the cases in the primary stages when they are susceptible to cure; how by such early treatment to limit the spread of the disease, this appears to me to be the most fundamental question facing the community in its relation to the management of syphilis. It is probable that the establishment of such clinics as this may in itself be a most effective measure in spreading to the general public the knowledge that treatment must be early if it is to be effective.

Finally, I wish to credit the success of this experiment (for such it has been) to the devotion and common sense displayed by Mrs. M. J. MaGee at the head of the social service department, and her assistants, successively, Miss C. G. Ashbrook, Miss B. W. Thatcher and Miss J. R. Null, and to the scrupulous attention to simple duty manifested by my colleagues, Dr. Richardson and Dr. Newcomer. Such a venture can only succeed in my opinion when character is given every chance to take its place as opposed to ignorance and careless self-will.

It is also a pleasure to recognize that our effort was preceded by the work of the Massachusetts General Hospital, Boston. My colleagues have had to meet this local problem in their own way, but the fact that a previous clinic conceived in the same spirit was in successful operation has cleared our path of many obstructive doubts.

Organization and Management of the Clinic (Newcomer). The syphilis patients are handled with the aid and coöperation of a social service worker. She devoted her whole time to the immediate direction of the patients and to following them up. The physician sees the patients at one dispensary period during the week and administers salvarsan on Saturday afternoon. The dispensary period is largely taken up with new cases and with a few old cases coming for more or less extraneous advice. On Saturday afternoon, besides receiving salvarsan, the patients are interviewed, progress of symptoms noted and mercury treatment prescribed.

The success of the clinic depends upon the regularity with which the patients come for their injections. The patients initially come largely from the various dispensaries of the hospital, referred by them to the social service department. The social service department actively interests itself in seeing to it that the patients are so referred. It is necessary to instruct and convince the patients as to the necessity of prompt and regular treatment, to look them up when they fail to appear, to give advice and encouragement, to investigate and perhaps organize their financial affairs so that they may pay for the salvarsan, to help them with the many extraneous problems which they may present. This advice and interest in the economic and social welfare of the patients reacts to increase their interest in and respect for us, so that they often come for advice and help on matters in no way related to their disease, developing a very real confidence in our motives and in our services.

Our clinic reaches for the most part a certain type of patients who, under the present condition of the labor market, are fairly well off, and who are rather respectable members of the community. A good many of them are single men working in and about Philadelphia who come to the dispensaries of the hospital for treatment for various minor ailments which are diagnosed as syphilitic. Relatively few of them are single women, about one-fourth of them are married

women, usually wives of other patients. Only very occasionally have we had professional prostitutes as patients, probably because that class is getting very little treatment. Of the few that we have had some have become quite regular patients. The majority have come two or three times and then stopped and we have lost track of them. The prostitute is, of course, the type of patient who should be treated. Why they do not receive treatment is not clear. The very poor, if also syphilitic, are usually physical wrecks and their social, economic and mental condition is on such a low level that nothing can be done with them. They are lazy, indifferent, hard to keep track of and usually soon disappear from observation. Unless they are infectious it often seems a waste of time to try to do much for them. We have, on the whole, very little difficulty in persuading those to take salvarsan who really should have it, and most of the patients represent a definite economic asset to the community.

The patients belong largely to the laboring class. They have only moderate incomes. They pay $3 a dose for the salvarsan. This has recently been increased to $4, in view of the prevailing high wage scale. None of us feels, after several years' contact with the problem, that the cost of the salvarsan is any real hardship to them. It is low enough so that they can pay for it month after month; it is high enough so that it is a sufficient sacrifice to enhance the value of it to them. We feel that a cheaper salvarsan, as could be dispensed by an endowed clinic, would not bring either a large number of patients or work greater good among those we have. They would tend to value the treatment less highly and come less frequently.

We give salvarsan free or at reduced cost to those who actually cannot pay, the free service making about 10 per cent. of the whole. These free patients are the least constant and faithful of our patrons.

The patients, as has been said, come largely from the dispensaries of the hospital and a large number of them continue to attend the dispensaries from which they first came. We, therefore, keep the records of these dispensaries continually up to date as regards the antisyphilitic treatment which we are giving to their patients in the salvarsan clinic.

An effort is made to have all new patients who come to the hospital and are referred to the laboratory for a Wassermann listed on our cards so that they can be followed up by our social worker. Those patients who appear at the hospital in an infectious condition are given neosalvarsan immediately by the intern in charge.

Those patients who are to receive salvarsan treatment obtain in advance from the social service worker a numbered and timed slip entitling them to the treatment, and it is administered to them in the order of these numbers. An effort is made to keep the patients waiting as little as possible and to arrange the time of injection so

as to be as convenient for them as possible. With exceptions the patient goes home immediately after receiving the treatment.

Administration of Salvarsan. The patient lies on an ordinary operating table provided with an arm-rest and receives the injection, usually in a vein of the arm, by the gravity method. An ordinary funnel and rubber tube fitted with a platinum needle is used, the funnel being suspended in a bracket from the ceiling. Three such tables are kept going at once. One nurse assists with the administration of the salvarsan while another boils the funnels and needles between patients. The records are kept up and accessible by a stenographer at a nearby table.

It has never been found necessary to cut down on the patient's vein; very occasionally it is necessary to ask the patient to return again for another trial. The needles are left in position in the vein without holding during the injection, they being freely inserted and the tubing disposed so that it lies without pulling on the needle. Long experience has shown us that a nurse cannot be trusted to hold a needle steady in a vein. She will unconsciously shift it through or out. No trouble is now experienced with subcutaneous infiltration of the salvarsan.

In order that one man may administer the drug to 50 to 70 people in an afternoon we have the salvarsan made up in quantities of about 20 doses at a time. This is done in a little room arranged for the purpose, equipped with scales, still, etc. The mixing is done by weight in "pyrex" flasks. The contents of a given number of ampoules are dissolved in freshly distilled water, and 2nNaOH is added from a burette until the precipitate is completely redissolved, a record being kept of the amount used. This averages 0.71 to 0.72 c.c. $\frac{N}{1}$ NaOH per 0.1 gm. salvarsan. The dissolved material is then made up to a volume of 30 c.c. per 0.1 gm. salvarsan by the addition of normal salt solution. We have lately changed the salvarsan mixing so that 0.85 c.c. $\frac{N}{1}$ NaOH is added per 0.1 gm. salvarsan and the whole diluted to 50 c.c. per 0.1 m. salvarsan. At injection the dose is measured out in a graduate, the size of the dose depending on the weight of the patient, condition of the kidneys and previous reaction to the drug.

Our routine is to give the patient a full dose of salvarsan once a week. Some patients are unable to come so often. We do not like to give it less frequently than once in two weeks. Wassermann reactions are made every seven doses and treatment continued for three times after a negative Wassermann, the Wassermanns being repeated frequently during the following year. Mixed treatment is prescribed throughout along with the salvarsan.

Results of Treatment. The treatment of the patients has been ordered with the view of giving salvarsan continuously, week after week, with the hope of thus securing a permanently negative Wassermann. We originally adopted this routine in the treatment of

syphilis because of the fact that we had had some success with it at the time our clinic was run on a much smaller scale, and there seemed to be some theoretical considerations in favor of it. For convenience of the discussion of our results in the treatment of syphilis the patients are grouped into different classes.

The first class of patients to be considered consists of twenty-six individuals who have had over twenty doses of salvarsan, some of them much more than this. Table I gives the doses which they have received and the Wassermanns which have been made upon them. Our mercury treatment has been, for various reasons, beyond our control, very irregular, although it was intended that it should continue parallel with the salvarsan treatment. At the top of the column is given a brief statement of the character of the disease for the particular patient. In analyzing the results of this table the most striking feature is the relatively poor results which have been obtained in most cases so far as the Wassermann reactions are concerned. In only the first and last is it likely that the Wassermann reaction is permanently negative. The first patient may never have had syphilis and the last commenced treatment soon after getting his initial lesion. The Wassermann reaction on patient No. 2 has oscillated so much that it is difficult to form any judgment as to his future. In most of the patients the Wassermann reaction varies from time to time, being occasionally negative or weakly positive, but, withal, remaining essentially positive. In most cases the patient's physical condition was very much improved early in the course of the treatment. While these patients may be, in a sense, obstinate cases, they are selected for the large amount of salvarsan they have had rather than for their clinical condition. Except in the case of individuals with early chancres, there are no patients having had less treatment who have become permanently negative. The group, as a whole, therefore, illustrates one of two things: either that in the majority of instances syphilis is very difficult to cure, *i. e.*, in which to produce a permanently negative Wassermann or the method of treatment has not been the most efficacious.

A second group of patients consists of twenty individuals who have had more than ten doses of salvarsan fairly continuously week after week. An analysis of them is given in Table II. It will be seen that as far as the Wassermann reaction is concerned very little is as yet accomplished with these patients. The belief is quite widespread that a moderate number of doses of salvarsan constitutes an adequate treatment for syphilis. These patients illustrate how little can be done with such an amount of salvarsan. Not only do they usually retain a positive Wassermann, but it is our experience that they almost always come back within a year or so with fresh symptoms of the disease, provided they stop at this stage of the treatment. In fact, this amount of salvarsan is usually inadequate even when commenced in the early stages of syphilis.

TABLE I.—THE TREATMENT AND WASSERMANN REACTIONS ON CERTAIN PATIENTS WHO HAVE HAD MORE THAN TWENTY DOSES OF SALVARSAN.

Patient.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Lesion.	Non-luetic.	Chancre.	Secondaries.	None.	Cerebrospinal lues.	None.	Gumma.	None.	None.	Periostitis.	None.	None.	None.	None.	Secondaries.	Cerebrospinal lues.	Cerebrospinal lues.	Mucous patches.	Mucous patches.	Leg ulcers.	Mucous patches.	Tabes dorsalis.	Tertiary skin lesions, macular.	Mucous patches.	Secondaries.	Chancre.
Previous dose.	11	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	°6	°3	:3	:3	:5	:3	:4	:4	:3	:3	:3	:4	:3	:3	:4	:4	:3	:4	:3	.3	:4	:4	:3	:4	:4	°5
2	..	..	3	4	3	..	5	..	4	5	3	5	3	..	..	5	3	..	4	..	5	5	5	..	..	5
3	..	3	4	3	5	6	..	..	4	6	3	..	3	..	6	6	3	4	5	..	6	5	5	..	6	6
4	..	3	4	3	..	6	5	..	..	6	3	..	3	3	..	6	3	..	6	3	6	5	5	6	..	6
5	..	3	..	3	..	5	..	..	..	4	3	..	3	3	6	6	..	3	5	2	6	5	4	..	6	..
6	..	..	4	3	..	5	5	..	..	6	3	..	3	3	6	6	4	..	6	3	5	5	6	..	..	5
7	..	..	..	..	:5	5	..	..	..	:5	3	5	°3	4	6	6	3	3	4	3	6	5	°4	..	6	6
8	..	3	4	3	..	6	5	..	:4	5	..	..	..	3	6	5	3	..	4	3	°6	5	°3	..	..	6
9	..	:3	4	:	5	:6	..	..	..	6	..	..	..	..	6	6	..	..	:4	3	6	5	5	..	..	6
10	..	..	..	3	°	6	..	..	4	6	..	5	3	..	6	4	..	..	6	..	6	5	..	5	°	
11	..	..	5	.	..	6	..	..	..	6	..	..	3	..	4	4	..	..	6	..	6	5	..			
12	..	..	..	3	..	5	..	..	4	5	..	:5	3	3	:6	3	..	..	6	..	6	5	..	:5		
13	..	..	..	3	..	6	:5	..	..	6	..	..	3	3	6	3	:3	..	6	2	..	5	:	..	..	°
14	..	..	5	3	:4	6	..	..	4	6	..	5	..	..	5	4	3	..	6	2	6	6	..	..	°	
15	..	5	5	3	..	6	5	..	..	:6	4	..	..	..	5	6	3	..	6	..	:6	5				
16	..	..	..	3	4	:6	..	..	4	6	5	5	..	..	6	:6	3	..	6	..	5	5				
17	°	..	..	•	..	6	5	..	..	6	..	..	:3	..	5	.	3	..	6	..	..	5	6	..	..	•
18	..	..	5	3	..	5	5	..	4	6	..	5	..	..	°6	4	°3	..	6	..	:6	5	5	..	:5	4
19	..	5	..	5	..	5	..	..	..	5	..	..	3	..	..	4	°3	..	:6	..	6	6	6			
20	..	..	..	5	..	5	..	..	..	:5	6	5	3	..	:6	4	..	..	6	..	:6	6	5	5		
21	..	..	..	3	4	..	..	..	..	6	6	..	3	..	6	4	..	..	6	3	6	5	3	..	4	4
22	..	..	°5	5	:4	..	:5	..	..	:6	..	..	3	..	:6	4	..	..	6	..	6	5				
23	..	..	..	3	..	..	..	..	..	6	..	°5	:3	..	6	4	..	..	6	3	:6	6	6	..	5	4
24	..	5	..	3	..	6	5	..	..	6	..	..	..	..	6	4	..	..	:6	..	..	6				
25	..	..	..	3	4	..	..	..	..	6	..	5	..	4	..	4	..	..	6	..	..	6	6	..	5	4
26	..	..	°	°	..	..	5	..	..	6	..	..	..	4	6	4	..	4	6	..	6	6				
27	..	3	..	6	4	..	..	..	..	:6	..	..	..	5	6	4	..	..	4	3	6	5	:6			
28	..	3	..	6	4	..	5	..	..	6	..	..	..	..	:6	4	..	3	..	3	..	6	6	:3	..	°
29	..	3	..	°	3	:6	..	..	..	6	..	..	..	..	:6	5	..	..	..	3	5	6	4			
30	..	:3	..	:	3	..	..	..	..	6	5	..	..	..	6	6	..	4	..	..	5	6	4			
31	..	..	6	3	..	..	..	..	..	6	5	..	..	..	..	:5	..	..	..	..	..	6	4	3		
32	..	3	..	..	5	5	..	..	..	:6	6	..	..	..	6	..	..	3	..	..	•	6	:6	3	°	°
33	..	3	..	3	3	..	5	..	..	°6	:	..	3	5	:6	..	..	..	..	..	°6	..	..	3		
34	..	3	..	..	3	6	5	..	..	..	..	..	..	5	°6	..	..	..	..	..	6	5	6	3		
35	..	3	..	6	3	..	5	..	..	:6	:6	..	3	..	..	..	..	..	..	3	:6	:5	6	3	..	:
36	..	5	..	6	3	6	..	..	..	:6	6	..	..	..	°6	..	..	:3	..	1	:6	..	°6	3	..	..
37	..	5	..	..	:3	..	..	..	..	5	..	°5	3	..	°	..	..	3	..	..	..	..	°	..	..	°
38	..	6	:	6	..	6	..	..	..	:6	..	:4	..	..	..	..	..	..	..	..	..	..	6			
39	..	..	4	..	..	..	:5	..	..	..	6	..	3	..	..	..	..	3	..	..	..	..	6	:	..	
40	..	6	6	5	..	:6	5	..	4	..	6	..	5	..	..	..	..	3	..	°3	..	..				
41	..	°6	6	..	..	..	5	..	4	..	6	..	5	..	..	..	..	..	..	..	..	..				
42	..	..	5	5	3	:6	3	..	..	..	..	..	:5	..	..	..	..	3	..	..	..	..	..	3	..	
43	..	..	6	..	..	..	3	..	4	..	..	..	..	..	..	..	4	3	..	..	..	..	..	3	3	
44	°	..	6	5	..	..	..	..	..	..	..	..	6	..	..	..	5	3	..	..	..	..	..	..	3	
45	..	..	6	5	..	..	..	..	..	..	6	5	5	..	..	..	3	..	..	..	..	..	°	..	3	
46	..	6	5	:6	..	..	..	..	..	..	6	3	..	3	..	..	5	..	..	..	..	..				
47	..	6	6	6	..	..	:3	4	..	..	6	3	6	..	..	..	5	..	..	..	..	..				
48	..	6	6	•	..	..	..	5	..	..	..	..	6	..	..	..	..	3	..	°3						
49	..	°7	6	°5	3	..	3	5	..	..	6	3	..	..	..	..	6	..	..	4	..	..	..	3		
50	..	..	6	..	3	..	..	5	4	..	6	3	..	..	..	..	:6	3	..	..	..	..	..	3		

The figures of the table indicate decigrams of salvarsan. A zero (°) before the figure indicates a negative Wassermann, a single dot (·) a one or two plus, and a double dot (:) a three or four plus Wassermann. Figures in first vertical column show time in weeks.

TABLE I—*continued.*

Patient.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Lesion.	Non-luetic.	Chancre.	Secondaries.	None.	Cerebrospinal lues.	None.	Gumma.	None.	None.	Periostitis.	None.	None.	None.	None.	Secondaries.	Cerebrospinal lues.	Cerebrospinal lues.	Mucous patches.	Mucous patches.	Leg ulcers.	Mucous patches.	Tabes dorsalis.	Tertiary skin lesions, macular.	Mucous patches.	Secondaries.	Chancre.
Previous dose.	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	..	..	6	6	3	..	..	6	..	..	..	..	..	..	..	..	°6	3								
52	..	..	:6	..	..	..	..	5	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	3		
53	..	..	6	6	..	..	3	6	4	..	..	..	..	..	..	..	..	..	..	4	..	..	..	3		·
54	..	..	°6	..	..	..	3	5	4	..	..	..	°	5	..	..	5	..	..	..	..	..	..	..	3	°
55	..	..	°6	..	..	..	3	5	4	..	..	4	..	5	..	..	..	..	..	4	..	..	..	4		
56	..	..	6	5	..	..	:3	5	..	..	..	6	..	:5	..	..	6	..	..	5	..	..	..	3		
57	..	..	.	6	4	..	..	4	..	..	..	6	..	5	..	..	:	4								
58	..	..	6	..	..	..	..	5	..	..	..	4	..	.												
59	..	°6	.	:6	..	..	..	5	..	..	..	6	..	5	..	..	..	..	..	..	..	..	..	:	5	
60	..	6	6	.	3	..	..	5	4	..	..	4	:	.	..	..	..	3	..	..	..	..	..	3	3	
61	..	6	.	:5	3	..	..	°5	.	..	..	°6	.	.												
62	..	6	.	.	..	..	..	6	4	..	..	.	.	·5												
63	..	6	.	.	..	..	..	6	.	..	..	.	.	.	..	..	..	3	..	..	..	..	..	..	3	
64	..	°6	°6	.	3	..	..	6	4	..	..	.	.	5	..	..	..	.	..	°	..	..	..	..	4	
65	·	6	.	.	..	..	..	5	4	..	..	.	.	.	..	..	..	3								
66	°4	.	.	6	..	..	..	.	3	..	..	.	.	:6	..	..	..	.								
67	.5	6	.	.	..	..	..	6	.	..	..	°	.	.	..	..	..	3	..	..	..	..	..	..	°	
68	:6	°	.	.	3	..	..	.	.	..	..	.	.	.	..	..	..	3								
69	6	°6	.	.	..	..	..	5	.	..	..	.	.	.												
70	6	.	.	.	..	..	..	.	:3	..	..	.	.	.												
71	6	6	.	.	..	..	..	:5	3	..	..	.	.	.	..	..	..	4								
72	6	.	.	.	5	..	..	.	.	..	..	°	.	.	..	..	..	4	..	..	..	..	..	..	°	
73	°5	·6	.	.	..	..	..	:6	.	..	..	.	.	.	..	..	..	.	..	:						
74	:6	.	.	.	..	..	..	.	.	..	..	.	5	.												
75	°6	°	.	.	..	..	..	.	.	..	..	.	6	.	..	..	..	4								
76	·6	.	.	.	..	..	..	.	.	..	..	.	.	.												
77	·6	°6	.	.	..	..	..	:6	.	..	..	.	.	.	..	..	..	4								
78	°6	.	.	.	..	..	..	.	.	..	..	.	6	.												
79	°	°6	.	.	..	..	..	6	.	..	..	·	.	.	..	..	..	:4								
80	°	.	.	.	5	..	..	.	.	..	..	6	6	.	..	..	..	.	..	..	..	..	..	..	:	
81	..	:6	.	.	5	..	..	.	.	..	..	.	.	.	..	..	..	.	..	..	..	..	..	..	4	
82	..	.	.	.	..	..	..	.	.	..	..	.	.	.	..	..	..	.	..	..	..	..	..	5		
83	..	:6	.	.	..	..	..	.	.	..	..	.	:6	.	..	..	..	.	..	..	..	..	..	5	6	
84	..	°	.	.	..	..	..	6	.	..	..	.	.	.	..	..	..	.	..	..	..	..	..	.	6	
85	..	.	.	.	..	..	..	.	.	..	..	6	.	.	..	..	..	5	..	..	..	..	..	.	6	
86	..	.	.	.	..	..	..	6	.	..	..	6	.	.	..	..	..	.	..	..	..	..	..	.	6	°
87	..	.	.	.	..	..	..	.	.	..	..	:6	.	.	..	..	..	.	..	..	..	..	..	.	6	°4
88	..	.	.	.	..	..	..	6	.	..	..	6	.	.	..	..	..	.	..	..	..	..	..	.	:6	°

The figures of the table indicate decigrams of salvarsan. A zero (°) before the figure indicates a negative Wassermann, a single dot (·) a one or two plus, and a double dot (:) a three or four plus Wassermann. Figures in first vertical column show time in weeks.

Table III gives a summary of the treatment of eighteen individuals with chancres, or who have recently had chancres, and who have received ten or more doses of salvarsan. Of these patients the first seven are probably permanently negative, a result that may be considered as good. The remaining eleven might be considered as standing henceforth clinically on the same basis as the patients of Table I. It is not clear why patient No. 9 did not get a permanently negative Wassermann, nor, indeed, that it may not be negative. In the case of patient No. 13 and perhaps No. 14 also

there may have been a mistake as to the age of the chancre. The condition of patients No. 17 and No. 18 is not clear. It is possible that in case the patient has a chancre, and has neither developed a positive Wassermann nor a systemic infection, ten doses constitutes an adequate treatment. We do not often get patients this early. As a whole this group of patients illustrates quite forcibly the fact that ten doses of salvarsan are not an adequate treatment for early syphilis.

TABLE II.—THE TREATMENT AND WASSERMANN REACTIONS ON CERTAIN PATIENTS WHO HAVE HAD MORE THAN TEN DOSES OF SALVARSAN.

Patient.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Lesion.	Secondaries.	Pains.	Periostitis.	Gumma.	Gumma.	Chest pains.	Optic atrophy.	Pains; nephritis.	Vitreous degeneration.	Leg ulcers.	?	Mucous patches.	Mucous patches.	Gumma.	Cholecystitis.	Joint pains.	Periostitis.	Periostitis.	?	Weakness.
1	:3	:3	:4	:5	:2	:4	:3	:2	:4	:4	:4	:3	:2	:3	:3	:3	:4	:3	.4	:4
2	3	4	5	..	4	..	3	2	5	5	5	4	..	5	..	4	5	4	5	5
3	3	5	4	5	..	5	..	2	5	6	6	5	..	6	4	5	5	..	6	6
4	3	6	..	..	..	..	..	3	5	6	..	..	..	6	5	5	6	..	6	6
5	3	4	..	6	5	3	3	3	..	6	6	..	3	6	5	5	6	..	..	6
6	3	5	4	..	..	..	..	4	5	6	6	5	..	5	5	5	6	3	6	6
7	3	5	5	4	4	4	3	5	5	6	6	6	..	6	5	5	5	..	6	°6
8	:5	..	..	..	4	5	3	5	5	..	6	..	3	6	5	4	5	4	6	
9	5	5	6	4	5	5	3	5	..	6	6	6	3	:6	5	:5	..	..	•	
10	6	:5	5	..	:6	5	:3	..	5	6	5	:6	3	6	..	5	:6	4		
11	4	6	5	:5	..	:6	..	4	5	..	..	..	..	:6	5	5	6			
12	6	5	..	..	5	..	..	..	4	6	:3	6	3	..	5	5	..	..	..	6
13	6	6	..	..	..	6	4	5	5	:6	:3	..	..	..	5	5	5	..	..	6
14	4	6	5	5	5	°6	4	5	4	..	..	6	3	..	5	5	6	..	..	6
15	:6	6	..	..	:4	6	4	..	:5	..	4	6	3	..	5	..	6	..	..	6
16	6	6	5	5	..	6	5	5	5	..	4	5	..	..	5	:5	°4	5	..	6
17	5	..	..	..	..	6	..	5	4	..	..	..	3	..	..	5	..	5	:5	6
18	6	..	..	5	..	..	5	6	5	..	..	6	3	..	5	5	4	5	..	6
19	•	..	..	..	..	6	5	:5	5	..	..	6	..	..	:5	5	..	..	5	:6
20	5	:6	..	5	..	6	:5	..	..	..	..	6	3	..	5	5	..	5	..	6
21	..	6	..	..	..	..	..	5	..	..	..	°5	..	..	..	5	..	..	..	6
22	..	..	..	6	..	6	..	5	..	..	..	°6	..	..	:6	..	..	..	5	6
23	..	6	..	..	..	5	..	5	3	..	..	..	5	..	..	..	..	..	..	6
24	..	..	..	:6	..	..	..	5	..	..	..	..	..	..	..	..	..	:4	..	6
25	..	6	..	..	..	:6	6	5	..	..	..	..	4	..	..	..	..	..	..	6
26	..	..	..	..	..	..	..	5												
27	..	..	..	..	..	..	:	..	..	..	..	..	:4							

The figures of the table indicate decigrams of salvarsan. A zero (°) before the figure indicates a negative Wassermann, a single dot (•) a one or two plus, and a double dot (:) a three or four plus Wassermann. Figures in first vertical column show time in weeks.

As a result of an analysis of these cases we can draw several conclusions: It is quite obvious in the first place, that the treatment of syphilis must be extended over a considerable period of time if it is to produce permanent results. In view of the fact that the general experience of syphilographers has tended to show somewhat better results than those that we are able to publish, we have come to the conclusion that our method should be modified, at least until we demonstrate that a new modification does not produce any better

results. Accordingly, instead of giving salvarsan continuously as long as the patient will consent to it we are now giving six doses of salvarsan, one each week, and following this course of six doses with a course of ten weeks of mercury treatment, preferably the inunctions. These periods of salvarsan treatment and mercury treatment are to be alternated continuously until a permanently negative Wassermann is secured and for one year thereafter. We have already found under this regime that it is more difficult than formerly to retain the interest of the patient.

TABLE III.—PATIENTS WITH RECENT CHANCRES, SOME OF WHOM HAD NOT YET HAD SECONDARIES.

Patient.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Age of chancre in wks.	14	6	8	8	3	12	8	3	1	4	8	8	2	3	10	12	3	4
Second-aries.	+	0	0	0	0	+	0	0	0	0	+	+	0	0	+	+	0	0
1	:3	:3	:4	:4	°3	:3	:3	:3	°3	:3	·3	3	:4	:3	:4	°3	:4	4
2	3	5	5	5	5	4	3	4	5	5	6	3	5	5	6	:5	5	5
3	5	5.	5	5	5	5	3	4	6	..	6	·3	5	5	6	5	5	5
4	3	6	5	:5	5	4	3	5	6	5	6	..	5	5	6	5	5	5
5	3	6	5	6	6	4	3	5	6	..	6	·3	5	5	4	5	5	6
6	4	6	..	6	5	4	3	4	..	..	6	3	5	6	4	6	5	6
7	5	..	5	4	5	·3	5	5	6	..	6	5	5	5	°5	4	3	
8	4	4	·5	:6	4	4	°5	6	5	5	5	4	:6	..	:5	..	·6	°5
9	5	..	5	..	°6	4	..	6	..	..	5	°6	6	·6	..	·5	·6	
10	°5	..	5	..	..	5	5	6	°6	..	6	..	6	6	..	..	6	
11	..	..	5	..	..	4	5	..	..	..	6	..	6	6	..	..	5	
12	..	·6	2	..	..	°3	5	°6	..	..	°6	..	6	6	..	..	6	
13	°6	6	6	..	..	4	5	..	..	..	°6	..	6	6	..	..	6	
14	..	3	6	..	..	°4	..	6	°4	..	6	..	..	6	..	5	°6	
15	..	..	°6	..	..	..	..	..	..	..	·6	..	..	6	..	..	..	°5
16	..	..	4	..	..	..	..	°6	..	..	..	..	..	°6	..	..	..	6
17	..	..	°6	..	..	..	..	5	·6	..	..	..	·6	6	..	..	..	°6
18	..	3		..	..	..	..	°6	..	..	..	..	6	6				
19	..	..	..	..	..	°	°	.	..	..	..	..	4					
20	..	..	..	..	..	..	..	°6	·6	..	..	..	5					
21	..	..	6	..	..	..	..	·6	..	4	..	..	6					
22	..	5	..	..	..	°	..	..	..	5								
23	..	..	..	..	..	..	..	°6	..	..	..	..	5					
24	..	4																
25	..	..	..	..	..	..	..	.	..	..	..	:						
26	..	4	..	..	..	..	..	°	..	..	..	5						
27																		
28	..	4	..	..	..	..	°											
29																		
30	..	°6	..	..	..	..	..	..	..	..	..	..	..	·5	..	..	..	·5
31	..	..	..	..	..	..	..	..	..	..	..	..	..	5				
32	..	..	..	..	..	..	..	..	..	..	..	..	..	6	..	..	..	:
33	..	..	..	..	..	..	..	..	..	..	..	..	..	6				
34	..	..	..	..	..	..	..	..	..	:5	..	..	..	:6				
35	..	4	..	..	..	..	..	..	..	5	..	·6	..	6				
36	..	..	..	..	..	..	..	..	..	..	..	°5	..	6				
37	..	..	..	..	..	..	..	..	..	..	..	:	..	6				
38	..	..	..	..	..	..	..	..	..	..	..	..	..	:6				
39	..	..	..	..	..	..	..	..	..	..	..	..	..	°6				
40	..	..	..	..	..	..	..	..	..	..	..	..	..	·6				

The figures of the table indicate decigrams of salvarsan. A zero (°) before the figure indicates a negative Wassermann, a single dot (·) a one or two plus, and a double dot (:) a three or four plus Wassermann. Figures in first vertical column show time in weeks.

TABLE IV.—LUETIC PATIENTS IN WHOM THERE WAS A CONSIDERABLE VARIATION IN THE WASSERMANN REACTION AS DONE FROM TIME TO TIME AND BY DIFFERENT METHODS.

Date.	Dose.	Wassermann reaction.		
		Cholesterinized antigen.		Noguchi.
		1 c.c. serum.	2 c.c. serum.	
		Patient No. 1.		
Feb. 2, '15	3	++++		
14, '15	4			
Sept. 4, '15	..	0		
Feb. 15, '16	4			
Sept. 9, '16	..	++++		
Feb. 10, '17	5			
Oct. 21, '17	..	++		
Jan. 12, '18	4			
Jan. 19, '18	5			
Feb. 2, '18	4			
9, '18	5			
16, '18	5			
23, '18	5			
Mar. 9, '18	..	++		
16, '18	5			
23, '18	5			
30, '18	5			
April 13, '18	5			
20, '18	5	++		
May 4, '18	5	++		
June 1, '18	6	++++		
22, '18	5	++++	....	+++
		Patient No. 3.		
June 29, '18	4			
July 6, '18	5	0	....	0
13, '18	6	++	++++	
20, '18	6	+++		
27, '18	5	+		
Aug. 3, '18	6	++++	....	+++
10, '18	5	+	....	0
17, '18	6	+	....	0
		Patient No. 5.		
June 30, '13	..	+++		
Feb. 3, '14	..	++		
16, '14	6	++++		
Mar. 23, '14	6			
July 16, '14	6			
Sept. 9, '14	..	++++		
Dec. 12, '14	..	+++		
Feb. 13, '15	..	++++		
April 20, '16	..	0		
Aug. 10, '16	4			
Mar. 7, '17	..	++		
May 26, '17	..	++		
June 28, '17	3			
July 19, '17	3			
Sept. 15, '17	3			
Oct. 27, '17	4			
Nov. 17, '17	5			
Dec. 15, '17	6			
Jan. 19, '18	6			
Mar. 16, '18	4			
April 27, '18	5			
May 11, '18	5			
July 6, '18	5	++	....	0
27, '18	..	++		

Date.	Dose.	Wassermann reaction.		
		Cholesterinized antigen.		Noguchi.
		1 c.c. serum.	2 c.c. serum.	
		Patient No. 2.		
Mar. 9, '19	3	++		
16, '18	4			
23, '18	5			
30, '18	3			
April 6, '18	6			
13, '18	5			
20, '18	6			
May 11, '18	6			
18, '18	4	0		
23, '18	6			
June 1, '18	3	++		
8, '18	6			
15, '18	6			
22, '18	6	0		
29, '18	6	++++		
July 6, '18	6	+	....	0
13, '18	6	+++		
20, '18	6	++++		
27, '18	6	++		
Aug. 3, '18	..	++	....	++
		Patient No. 4.		
June 21, '17	3	++++		
Aug. 11, '17	3			
18, '17	3			
Sept. 15, '17	3			
Oct. 6, '17	5			
27, '17	5			
Nov. 17, '17	5	0		
28, '17	..	0		
April 15, '18	..	0		
Aug. 17, '18	..	++		++++
		Patient No. 6.		
July 13, '18	4	++++		
10, '18	5	++++	....	
27, '18	5			
Aug. 3, '18	5			
10, '18	5	++++	....	0
17, '18	5	++++	....	0
		Patient No. 7.		
June 22, '18	4			
29, '18	5	++++		
July 6, '18	6	++++	....	++++
13, '18	6	+	++++	
20, '18	6	+++		
27, '18	6	0		
Aug. 3, '18	6	++	....	0
10, '18	5	+	....	0
17, '18	5			
24, '18	..	0		

TABLE V.—PATIENTS IN WHICH A POSITIVE WASSERMANN IN CONNECTION WITH THE CLINICAL PICTURE LED TO PROBABLE MISTAKE IN DIAGNOSIS, CHOLESTERINIZED ANTIGEN.

Patient.	1	2	3	4	5	6	7	8	9
Diagnosis.	Leg ulcers.	Epilepsy.	General pains.	Dizziness.	Perforated septum.	Hereditary lues.	?	Blood donor.	Deafness.
1	:3	:3	:3	:4	:3	:4	:3	°4	:3
2	5	4	4	..	3	5	4	4	
3	..	5	5	5	3	4	3	4	5
4	..	5	5	..	4	..	4	4	6
5	5	5	4	5	5	5	4	..	5
6	..	5	4	5	5	5	4	6	
7	6	..	3	5	5	5	4	..	5
8	6	5	3	6	°5	..	°4	..	5
9	6	5	4	6	5	..	5	6	5
10	6	°5	°4	..	°6	..	..	6	5
11	6	..	5	:5	..	5	..	..	5
12	..	°6	5	..	..	..	..	..	5
13	6	..	..	°6	..	5			
14	5	..	..	..	..	..	..	..	5
15	6	..	..	..	..	°5	°	..	°
16	..	..	..	°6	..	..	..	..	°5
17	6	..	°	..	..	..	..	4	
18	°6	..	..	..	..	..	..	°4	
19	°5	..	°	..	..	5			
20	..	..	°	..	..	..	°	°	°

The figures of the table indicate decigrams of salvarsan. A zero (°) before the figure indicates a negative Wassermann, a single dot (·) a one or two plus, and a double dot (:) a three or four plus Wassermann. Figures in first vertical column show time in weeks.

TABLE VI.—THE ECONOMIC STATUS OF TWELVE PATIENTS AS INFLUENCED BY THE ADMINISTRATION OF SALVARSAN.

Patient.	Maximum earning capacity per week.	Duration of incapacity, weeks.	Weeks of treatment to remove incapacity.	Cost of time lost during incapacity.	Cost of treatment to date of resuming work.	Amount which could have been saved by prompt treatment.	Time in weeks which could have been saved by prompt treatment.	End-result.
1	$25	8	4	$200	$12	$88	4	Loses a day occasionally.
2	30	5	2	150	6	84	3	Works regularly.
3	35	8	3	280	9	66	5	Works regularly.
4	25	12	3	300	9	216	9	Works irregularly.
5	20	5	2	100	6	54	3	Works regularly.
6	25	6	3	150	9	66	3	Works regularly.
7	15	8	2	120	6	84	6	Works regularly.
8	25	4	2	100	6	44	2	Works regularly.
9	35	3	1	105	3	67	2	Works regularly.
10	38	3	1	114	3	73	2	Works regularly.
11	35	4	2	140	6	64	2	Works regularly.
12	18	12	2	216	6	174	10	Works regularly.
Total .	$326	78	27	$1975	$81	$1080	51	

It is a very difficult thing to judge about the results of treatment unless a large number of cases are before one, a larger number than we here have at our disposal. If one regards the results of syphilis work from month to month and considers only small groups of patients, various impressions are received as to the results obtained. At times there will be several patients who have had a reasonable amount of salvarsan who, for some reason or other, are coincidentally negative. But if a few months are allowed to go by one is usually disappointed by having the negative Wassermanns on these patients return to positives.

Everyone knows how quickly salvarsan clears up certain luetic lesions, more particularly those of the surfaces covered by epithelium. Except in the cases of tabes dorsalis we have never given salvarsan over any considerable period without an appreciable improvement in the clinical picture. This fact should be borne in mind when reviewing the not very encouraging serological results of the tables.

Syphilis and Pregnancy (Richardson). During the past two years' treatment of syphilis at the Pennsylvania Hospital there have come under observation 12 syphilitic women who were pregnant at the time or who soon became pregnant. Of the 12, 9 had a history of miscarriage previously. The number of miscarriages varied from one in one case to four in several cases. The diagnosis was based on the history of miscarriages and positive Wassermann tests in both the patient and the patient's husband, together with a history and physical signs of syphilis. Only one case failed to show a positive Wassermann, and in this the physical examination and outcome of treatment made the diagnosis certain.

The 3 cases without history of miscarriage had not been pregnant before. All, however, had a clear history of syphilis, including a positive Wassermann test.

Of the 12 cases, 6 were treated during pregnancy and 6 before pregnancy had commenced.

The treatment varied in dosage from one dose of 0.6 gm. of neosalvarsan to several of neosalvarsan and salvarsan, most of the cases receiving a total of about 1 gm. of salvarsan divided among two or three doses.

In most of those treated during pregnancy the treatment was given before the fourth month. However, in one case seven months' pregnant when first seen and with a history of four miscarriages and stillbirths, treatment was given without any bad results.

All of the cases treated progressed to full term. Those who were not pregnant at the time of treatment became so within a year. Normal children were born to all of the patients treated. These children were examined and in several Wassermann tests done, all being negative. They have been seen occasionally since birth and no case of syphilis has yet developed among them.

The condition of the mothers improved with treatment, though several still showed signs of syphilis, with positive Wassermanns even after the birth of apparently normal children.

SALVARSANS AND SALVARSAN REACTIONS (Newcomer). Our salvarsan experience has been sufficiently large to give some accurate data on the question of salvarsan reactions and the involved question of the toxicity of the various salvarsans on the market. During the past year we have given three thousand doses and have had quite varied experience with reactions.

Nausea and vomiting, following immediately or several hours after the administration of salvarsan, is the most common reaction. It is usually supposed that this reaction is in large part inhibited by having the intestinal tract empty. While this seems to help with some there are others with whom it certainly does not help. The most efficient way of preventing this reaction is the slow administration of salvarsan. We ordinarily give salvarsan so that the injection is completed in two or three minutes. If it be allowed to take ten to fifteen minutes, patients seldom have nausea.

Anyone with any considerable experience has seen the so-called "nitroid" reaction, occurring after about 0.2 or 0.2 gm. has been given. The patient becomes dyspneic, has a very considerable fear of death, with a sensation of drowning, the pulse becomes feeble and rapid, the face becomes quite flushed, followed in a few minutes by a very marked pallor, with cyanosis about the lips and sometimes with considerable edema of the face. Edema of the lungs probably occurs, but is not considerable. There is sometimes laryngeal involvement, with dysphagia. The patient usually recovers quite rapidly, often feeling much better in fifteen to thirty minutes, but looking pale and sick for several hours afterward. The reaction sometimes has the appearance of being very serious. We have seen the reaction followed by relapses, the patient going through the same cycle several times hour after hour. We have never seen a serious ending.

There is a peculiar reaction which sometimes occurs following the administration of salvarsan, evidenced by intense pain across the sacral region, pain which is not eased by any position and which is exaggerated by movement. The pain has usually disappeared within a half hour. It is presumably vasomotor in its origin.

There is a local reaction of the veins used for injection, which is fairly common and sometimes important. Sometimes when one is injecting salvarsan into a vein which lies for a considerable distance superficially in the skin, the vein will be seen to contract throughout its entire length and become like a whipcord. The salvarsan ceases to flow and the condition continues for some time. Under some not very well-defined circumstances this contraction remains and is followed by thrombosis. The thrombosis may occur without the contraction having been specifically noticed. The patient

usually feels some pain, often referred to the shoulder, and during the following week the arm is painful along the course of the vein. This thrombosis, while it involves only the veins of the arm, may be very extensive, especially if attempts at injection are made in several veins. The reaction may be more localized than above described and involve a short segment of the vein only. Localized thrombosis certainly sometimes occurs, due to injury to the vein because of faulty technic; but the reaction undoubtedly occurs when injury to the veins is out of the question, when the vein is large and free and the needle small and sharp. It occurs more frequently as the amount of NaOH in the salvarsan solution is increased. It is more common in colored people than in white people, and it is at times impossible to continue to give them salvarsan because of this reaction.

In those patients who repeatedly have the anaphylactic "nitroid" reaction it is usually the case that neosalvarsan does not produce such a reaction, and may therefore be given instead of the salvarsan. It is probable that neosalvarsan does not produce venous thrombosis to the same extent as salvarsan, and in fact tends to be the only form in which the drug may be given repeatedly to negroes.

Salvarsan sometimes causes a dermatitis of rather serious character. A day or two after the injection there appears a reddened scaly lesion which itches considerably. The lesions are macular, with some thickening of the skin. The superficial layers peel off and give a fine scale. Sometimes the lesion is less sharply defined, consisting of a diffuse thickening and reddening of the skin.

The lesion may appear any place: on the ears, on the back of the hands, on the face, on the shoulder or very extensively over the body. It is very irritating, and if scratched can become secondarily infected.

The lesion usually develops only after very considerable salvarsan treatment. Sometimes treatment can be continued for some time without the lesion any more than continuing as an unimportant affair. But at any time the lesion may become so extensive as to be very serious and even to menace life itself. Further, a mild lesion may slowly become progressively worse in spite of salvarsan having been discontinued. While infrequent this skin reaction constitutes the most serious obstacle to the continued administration of salvarsan, excepting only venous thrombosis in the negro, which we have described above.

We should mention here the question of nephritis as related to salvarsan reactions. In the past we have had two deaths following the use of salvarsan, and due primarily to a salvarsan nephritis. Within a few hours after administration of salvarsan the patient gets all the symptoms and signs of severe acute nephritis. If he dies from the nephritis it usually is a matter of four or five days.

There is, however, another form of death, more specifically salvarsan in character, which is accompanied by cerebral symptoms, by paralysis of various sorts and in which the nephritis picture is not so prominent. The reaction is apparently caused by or at least aggravated by the retention of salvarsan, due to the presence of a coincident nephritis, whatever may be the cause of the latter. It is impossible to tell when reactions of this type are going to occur. They are certainly very rare. It would seem very probable that they are dependent upon some type of kidney lesion involving a very definite set of kidney cells, perhaps even more specifically so than is the case with mercury-poisoning. At any rate the presence of a demonstrable nephritis, even a very severe nephritis, is no indication whatever that this reaction is going to occur, and when it does occur it does so usually in patients who have only a rather insignificant chronic nephritis. We have given salvarsan repeatedly time after time during the last year to patients with chronic nephritis without any trouble whatever. Several years ago we carried on kidney functional tests, calculating McLean's coefficient for urea and NaCl excretion, both before and after giving salvarsan, in the case of about ten individuals having slight kidney lesions, without noticing any change in the coefficients before and for several days after injection.

There is, as a further question, the relation of these various reactions to the make of salvarsan which is used. During the past year we have used about equal quantities of the H. A. Metz salvarsan, arsenobenzol, Poulnec Frères, and arsenobenzol of the Dermatological Research Laboratories, Philadelphia. These salvarsans possess quite obvious physical differences. The New York salvarsan is usually quite dark in color and relatively soluble. The arsenobenzols are light in color. The French is quite soluble. The present Philadelphia Polyclinic preparation is quite insoluble. None of them is as light as the original salvarsan. Aside from their differences in color and solubility they behave very much alike. Certain lots of any of these salvarsans are occasionally poor in the sense that they contain insoluble elements clouding the solution. What pharmacological effect these impurities may have is a subject upon which we have no information. We have the impression that the original salvarsan keeps better after it is mixed than do the present salvarsans. Any salvarsan keeps very well for several hours, and even for half a day, provided it practically fills a clean flask. If the salvarsan be placed in a flask which has become soiled through its use for several hours as a salvarsan container it deteriorates much more rapidly, the oxidation process having been previously started.

Salvarsan has the reputation of being very easily oxidizable as a powder, a reputation which is probably exaggerated. In the manufacture and tubing of the salvarsan there is abundant opportunity for oxidation to be initiated and, to a slight extent, to continue. The salvarsan is dried in an atmosphere of carbon dioxide rather ineffi-

ciently maintained. It is, however, transported, weighed and tubed in the ordinary air, and it is only after quite a few hours that the ampoules are exhausted and filled with CO_2. The differences in color of the salvarsans are certainly not due to oxidation. Manufacturers state that they are due to the differences in raw products which they are compelled to use, impurities being carried over which give it the color and which it is impossible to remove. Salvarsan is very toxic under some conditions, sufficiently so to produce death in ordinary doses. That these deaths or reactions are essentially due to the particular salvarsans used is open to doubt. Variations in the toxicity of salvarsans do occur, but some other factor than these variations must be responsible for the wide variations as observed clinically. Every once in a while for some unknown reason, probably often not connected either with the preparation or administration of salvarsan, the drug causes death. As a coincidence which the laws of chance always allow, there may be several deaths, or severe reactions, and immediately one blames the particular preparation which is being used. The fact that we have had no deaths with any of these salvarsans we attribute to chance. We have seen and been informed of deaths which other people have had and for which we have not been able to establish any reason in comparing the circumstances with our own practices.

From time to time we have purposely used batches of salvarsan which have given severe reactions either in our own hands or in those of other people, and always we have failed to again obtain the reactions. From our experience we are therefore forced to conclude that, aside from the matter of color and the time consumed in dissolving them, there are no practical differences in the various salvarsans as observed clinically.

The Wassermann Reaction (Newcomer). It is desirable, perhaps, at this point to consider briefly relationships between Wassermann reactions and syphilis. We have published elsewhere some considerations of this sort.[3] There are brought together in Table IV some interesting relationships which occasionally occur and which it is well perhaps to emphasize. The table is designed to show the way in which the Wassermann reaction may vary from time to time in the same individual, being now strongly positive, now weakly positive, now negative, and this in patients in which the clinical diagnosis of syphilis is quite certain. The table shows how little reliance can be placed upon a single Wassermann as far as indicating the patient's condition is concerned. It should also be emphasized that while the Wassermann reaction frequently becomes weak before it becomes negative it is certain that, as a general rule, the strength of the reaction bears no relation to the course of the disease. One cannot infer from a single weakly positive or even

[3] P. A. Lewis and H. S. Newcomer: Jour. Exper. Med., 1919, vol. xxix, p. 351.

negative Wassermann reaction that there is any permanent change in the reaction. We might properly say here that in patients with syphilis it is usually the case that the cholestrolized antigen gives more positives than any other Wassermann system, and it is safer to use it than other Wassermann systems as a guide in the treatment of syphilis.

On the contrary, in the diagnosis of syphilis cholestrolized antigen may be too sensitive and may give weakly positive and sometimes strongly positive reactions with normal individuals. We have been in the habit up until recently of regarding a strongly positive Wassermann reaction with cholestrolized antigen as a sufficient evidence of syphilis. There is brought together in Table V a set of individuals having such strongly positive reactions who were so inducted into our salvarsan clinic. A more careful examination of their history fails to give any positive evidence of syphilis—in fact, is suspiciously negative in that regard—and these individuals can probably be legitimately regarded as non-syphilitic. The table shows to what an extent mistakes of this sort can be made.

There is a further aspect of the Wassermann question which must be considered. It is conceivable that those people who have had a great deal of salvarsan treatment paralleled with and immediately followed by positive Wassermann reactions may eventually become negative without further treatment. If that be so our results may not be so poor as they seem. It is probably not so. There is a very large question as to just what significance should be attached to a variable Wassermann reaction following a long course of treatment. We have had patients long negative who have subsequently at times shown positive Wassermanns in a negative series. Salvarsan has been given but perhaps it was not necessary. It is, however, probable that people who have had a great deal of salvarsan are better protected against later serious lesions than those who have not had such treatment. As previously mentioned, it is also undoubtedly true that those who get a small amount of salvarsan often relapse, and may relapse early. Our results support the view that treatment in the early stages of the disease should be the most vigorous possible. Just what course should be followed later is still problematical.

The patient under any circumstances must look forward to a very tedious course of treatment. He has one of two alternatives: He may take treatment, half a dozen doses or so, sufficient to heal his present lesion, and then wait for a recurrence. This may or may not come. If it comes early he can take more treatment and go through the same thing again. It may come late and be a serious central nervous system lesion. He may, on the other hand, take a very strenuous course of treatment of one type or another over a period of several years and then, as a result of the history of many decades of past experience in the treatment of the disease, he can

count with some certainty on having no further trouble. How much these years of treatment may be lessened by the modern method of treatment with salvarsan would seem to be somewhat a matter of conjecture.

Economic Results. There is another side of the salvarsan story which alone compensates for a clinic such as we have, that is, an economic saving to the individual and to the community. When we think of the Pennsylvania Hospital for the Insane and consider that 15 per cent. of its patients are syphilitic, that its cost on this account amounts to a large sum, and that this by no means accounts for any considerable portion of the indigent syphilitic patients of the city, we can conjecture how much the nation may be paying out to support these people. If we could add the time as efficient wage-earners which is lost by being incapacitated the economic loss to the community would be large indeed. This is most concretely expressed perhaps by showing what systematic treatment may effect in a monetary way to the individual. A table has been prepared which picks out specifically twelve patients whose earning capacities are given, whose immediate loss of time due to the incapacitation in consequence of the disease and the cost of whose treatment and the time and amount of money saved through the agency of the salvarsan clinic is also given. It will be seen that for these twelve patients treatment costing them $81 saved them $1080 earning capacity and a year of time. If the clinic were a charity, which at present it is not, a charity so expended as to bring in 1000 per cent. on investment would be a very profitable one indeed.

Financial Statement. Our gross income based on an average attendance of 75 patients a week is approximately $10,000 a year. Our expenses may be tabulated as follows, also approximately:

Salvarsan	$4200
Physician	600
Social service worker	900
Nurse (one day a week)	250
Laboratory service (one day a week)	100
Miscellaneous supplies	600
Social service expenses	200
Drugs	300
	$7150

SUMMARY (Lewis). Our experience as presented in the preceding sections shows that it is practicable for any well-organized general hospital to establish a clinic for the treatment of syphilis without great expense to the institution and to the certain advantage of the community it serves. The fundamental questions of morality which underlie the spread of this infection do not properly present themselves for the consideration of the physician and the hospital in connection with such a clinic. The practice of segregating the syphilis clinic from the more general work of the hospital, which has

been so general, should be abandoned, as it makes the treatment appear to the patient in the light of punishment and to the hospital staff and management as a disagreeable duty. The interests of all are thus sacrificed to sentiment, and in the confusion the propaganda for better morals is not effectively advanced.

Medically speaking, our results confirm the prevailing view that once syphilis has invaded the body it is very difficult if not impossible to eradicate. Systematic treatment is, however, capable of minimizing its effects for the individual, and at the same time rendering him almost innocuous to the community. Such a clinic as this is probably more successful in securing treatment in this systematic way than is management by the private practitioner.

It being assumed that such clinical facilities as those described have been made available in adequate amount, the attack on syphilis as a community problem should involve as a measure of the first importance systematic effort to secure treatment at the earliest possible moment for those infected.

THE CARDIOVASCULAR DEFECTIVE.

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When material is plentiful it is not an unusual experience to discover new diseases or new symptoms or new relationships between diseases and symptoms. Impressions and facts found and seen in isolated cases which do not seem striking, assume added importance when seen time after time over a brief period in numbers of cases.

To most physicians the opportunity of observing thousands of the young manhood of this country, both well and ill, has come as a wonderful experience. Out of it has developed a great number of most valuable observations, many of which are of use in the civilian practice of medicine, surgery and allied branches. We have had to change certain of our ideas. Other ideas we have been able to establish on a firm basis, and still other ideas have been developed as we have gained in experience.

It was not unknown before the late war that there was a group of young men who suffered from inability to adjust themselves to their environment. Such cases were, for the most part, seen by neurologists who classified them among the psychoneuroses. Some cases who complained more particularly of their hearts fell into the hands of the general practitioners or the heart specialists. The number of

such cases was not great and the lack of any somatic lesion caused physicians to relegate them into the motley group composing neurasthenia. For the most of us to call a group of symptoms neurasthenia was an admission of diagnostic limitations. We felt that because so many loosely termed neurasthenics were found on careful study to have definite pathological lesions which could account for their nervous instability, all cases of neurasthenia should show some pathological basis. We very probably erred in swinging the pendulum too far on the physical side and neglecting too much the purely mental reaction of the patient.

The great variability of persons in their emotional spheres and in their subconscious reactions to varieties of stimuli certainly were not appreciated by the great majority of the profession. The inhibitory effects of training at home and in school were little considered. Inheritance, although stressed by many recent writers, did not have the place that it deserves in our summation of the factors which make a diagnosis. It was not that all these terms were not known and comprehended; it was that their full significance was neither fully understood nor fully appreciated.

The syndrome which is found in the cases called here cardiovascular defective has only received attention since the war began. This term is used in this paper synonomously with effort syndrome, irritable heart or neurocirculatory asthenia. Lewis and his associates first directed attention to this syndrome in soldiers who were invalided from the war fronts with the diagnosis, "Disordered Action of the Heart" (D. A. H.). Since his work cases having a similar group of symptoms brought out on exercise have been found not infrequently in civil life in men coming up for examination for military service. It is this latter class of men which form the material for this paper.

Certain characteristic symptoms are found in all cases of the cardiovascular defective. These are symptoms from which many men suffer when put through violent exertion. The differentiation between the defectives and the normal men is largely one of degree. Exercise of the lightest character serves to bring out in the defectives an exaggeration of all the symptoms of exhaustion. Typically after slight exertion the men become breathless, giddy, have pain over the precordium, palpitation of the heart and have a feeling of utter exhaustion. Frequently they have headache, are sleepless, rest at night really does not rest them and they have clammy, cyanosed hands and feet. They sweat profusely in the axillæ and have a mottled skin and unstable vasomotor reaction.

This train of symptoms follows practically every serious illness and lasts for a long or short time, depending upon the recuperative powers of the person affected and upon the severity of the illness. This is to be expected and causes no anxiety. It is only when the time has passed that recovery should be perfect and symptoms still

persist that permanent damage to the cardiovascular system may be suspected.

These men are not really ill. They have come before the examining officers at recruit depots as volunteers and as drafted men and have been passed by their local and advisory board examiners as normal men, although the increased frequency of the pulse-rate has been noted. This rapid heart action has been attributed to slight nervousness during examination rather than to any inherent defect in the man. Frequently such men do not have a pulse-rate over 100 to the minute and according to instructions in the *Manual* (Form 75, P. M. G. O.) have been passed without further questioning. The enormous amount of work which local boards were called upon to perform and the poor facilities often present for careful examination have been fruitful causes in the induction of such men into general military service.

During the first draft many of these men were passed by the army surgeons and sent to training camps, where their defect was early discovered during training, and they were brought before special boards and were given their discharge. Such apparently healthy men who could not perform the duties of a soldier were the bane of the cardiovascular boards at all the training camps. The knowledge that such a condition could exist in an apparently robust man was at first viewed with some skepticism and many men were thought, most unjustly as we now know, to be "slackers." Gradually it was borne in upon the army examiners that the defect was a real one and that these men were really physically unable to stand any violent exercise. The thorough appreciation of this condition never became universal, so that during the second and succeeding calls for men there were many of these defectives sent to camp.

With us at Jefferson Barracks, Missouri, an attempt was made to cull out these defectives before they were taken into the service. We were not wholly successful in that certain men who were examined before we fully appreciated the condition and who apparently were normal, later were admitted to hospital with the characteristic symptoms. These men had developed the symptoms under the setting-up exercises and comparatively light military duty given them at this post. Certain men, thought by us to be border-line cases, given the benefit of the doubt and accepted, also later were admitted to the hospital. Under such conditions it seemed to us most important to determine, if possible, the exact status of these defectives before finally disposing of them at the examining barracks. Consent was obtained from the surgeon, Lieut.-Col. C. E. Freeman, to place all suspected cases in a hospital ward and tents near the hospital, so that these men might be observed over a sufficient period to enable us to pass upon them intelligently.

To this end the cardiac examiners in the examining barracks were requested to refer all cases of increased pulse-rate to a special

examiner, in the same building, for his opinion. There was plenty of time to examine carefully, in a quiet room, all referred cases. The method used in examining the hearts of the recruits and drafted men lent itself well to the selection of the tachycardias. The men hopped a distance of about 80 feet, half the distance on the right foot and half on the left. They lined up in sections of fourteen in a room where two medical officers were, one who examined the heart and the other who examined the lungs. By the time the group had been examined enough time had elapsed for the normal heart to return to normal rate. The exercise was enough to contin ıe acceleration of the pulse-rate in the defectives over a period of several minutes. Tachycardia under such circumstances was considered to be of sufficient significance to demand further and more careful examination.

Tachycardia is known to be produced by a variety of conditions. Hence, at the final examination in the barracks by the two members of the special board, the tuberculosis and cardiovascular examiners, cases were sorted into several categories. Some were frankly tuberculosis and were at once rejected. Some were cases of exophthalmic goitre, of definite hyperthyroidism, of cirrhosis of the liver, chronic malaria with enlarged spleen, bronchial asthma, etc., and were at once rejected. There were, however, others which could not be so summarily dealt with. These were cases in which tachycardia or a very labile pulse was found and in whom no definite lesion of any kind could be discovered. These men were sent to the hospital for further observation and examination. A uniform history was obtained from every man according to the subjoined history form:

HISTORY FORM.

Family History:

1. Father or mother alcoholic? Ans.
2. Father or mother nervous? Ans.
3. Father or mother insane? Ans.
4. Father or mother tuberculous? Ans.

Past History:

1. How long have you worked? Ans.
2. Just what do you do? Ans.
   Sedentary Light Moderate Heavy
3. Have you had to quit a job because too hard? When?
4. Ever become dizzy or faint at work? At play? When?
5. Are you short of breath on exertion? Ans.
6. Ever had pain over your heart? When?
7. Ever had palpitation of the heart? Ans.
8. Do you sweat or flush easily? Ans.
9. Are you subject to headaches? What part of your head?
10. Are you nervous, easily excited?
11. What fevers have you had? When each one?
12. When did you *first* notice any trouble? Ans.

After careful examination the men were placed in squads and daily exercised with mild setting-up exercises under the charge of a non-commissioned officer who had been schooled in the drill. The exercises recommended by Lewis were used. His C^{15} and D^{30} were given, supplemented by hikes of varying distances and periods of double-quick. Temperature readings and pulse-rates were taken on all patients every three hours. Exercise was so timed that the 3 P.M. readings were taken from twenty minutes to half an hour after exercise. In this manner we studied over 400 referred from the heart and lung room in the examining barracks. Many of these proved to be simple excitement tachycardia and no record was kept of them.

We studied carefully 315 cases and exercised 158 in the hospital. In 297 the records were complete enough for later use.

DISPOSITION OF CASES AT EXAMINING BARRACKS.

60 cases (37.0 per cent.) diagnosed hyperthyroidism, rejected.

47 cases (29.0 per cent.) diagnosed pulmonary tuberculosis, rejected.

52 cases (32.0 per cent.) diagnosed irritable heart, rejected.

2 cases (1.2 per cent.) diagnosed cirrhosis of the liver, rejected.

1 case (0.8 per cent.) diagnosed bronchial asthma, rejected.

DISPOSITION OF CASES OBSERVED IN HOSPITAL.

40 cases (29.6 per cent.) no lesion found, normal, accepted.

17 cases (12.6 per cent.) diagnosed hyperthyroidism, rejected.

47 cases (34.8 per cent.) diagnosed pulmonary tuberculosis, rejected.

29 cases (21.5 per cent.) diagnosed irritable heart, rejected.

2 cases (1.5 per cent.) diagnosed cirrhosis of the liver, rejected.

It will be seen that cases of pulmonary tuberculosis and hyperthyroidism (including exophthalmic goitre) composed the greater proportion of the two groups. As a matter of fact the symptoms complained of by men are so similar in the cases of the diseases named above and irritable heart that it is only after the most careful study that the cases can be separated into the proper group.

Our cases of irritable heart, the cardiovascular defective, fall into three groups:

A. Strictly cardiovascular.

1. Following infectious disease. Chronic myocardial degeneration.
2. Existing since childhood.
   (*a*) Associated with poor mentality.
   (*b*) Associated with good mentality.

B. Some defect in endocrine secretion.
   1. Hyperthyroidism.
   2. Exophthalmic goitre.

C. Associated with definite somatic lesions.
   1. Pulmonary tuberculosis.
   2. (Hodgkin's disease).
   3. Focal infectious: chronic.
   4. Other diseases: cirrhosis of the liver (hookworm), asthma, etc.

A. The following case is typical of the first group, subsection 1:

CASE 21, A. W. S., recruit, aged twenty-seven years, a farmer. His father died of cancer of the stomach. His mother is living, but is nervous. She has heart trouble and rheumatism. He has three half-brothers, one half-sister, children of the same father. All are well. His mother was thirty-four years old when he was born. He went through the country school but did not pass in all branches. Can read, write, spell and compute fractions. He left school at the age of sixteen and has worked on a farm since. Has worked hard, and up to five years ago had never been ill. At that time he had rheumatism, evidently artic ılar, which lasted for three months. He has never since that time been able to work hard. About one year ago he had "heat stroke." Since then he tired even more easily, has palpitation of the heart, gets dizzy and short of breath on slight exertion. The patient is tall, a healthy looking and well-muscled man. Pulse sitting 94, very labile. Hops ninety times on one foot and then is exhausted, dizzy. Pulse is 142, regular. He is breathless, has no pain. Two minutes later, pulse 112. The apex-beat is in the fifth interspace 7.5 cm. from the midsternal line. Heart sounds are clear. The pulmonic second is accentuated. Diagnosis: Irritable heart, caused by acute articular rheumatism resulting in myocardial weakness.

This case seems to have followed a severe attack of articular rheumatism, although the sunstroke was claimed to have made the man more easily exhausted. We have had several such cases. All occurred in farmer boys and all dated their symptoms from the sunstroke. If sunstroke, as claimed by some, is an infection, then the cases of effort syndrome following this cause must be classed as myocardial in character.

CASE 10.—A more typical case is that of P. B., recruit, aged twenty-five years, single, an automobile machinist. The family history is negative. He was never really ill until four years ago. He went through the eighth grade in school, then took a course in an automobile school. Four years ago he had a severe attack of typhoid fever. Since recovery he has been exhausted easily, had precordial pain and breathlessness on slight exertion. He is not ill or incapacitated for his work, which is light. He is a well-muscled man. Pulse standing, 136; heart sounds are loud, with a short systolic murmur at the apex. Apex-beat is found in the fourth interspace, 8 cm. from

midsternal line. He hops one hundred times without great difficulty. The heart pounds 176 times to the minute; there is breathlessness and some dizziness. After three minutes rate is 148; breathlessness still present. Apex of heart definitely moved to left, showing dilatation on exercise. Diagnosis: Irritable heart, effort syndrome.

Cases belonging to the second subgroup of the first Group A are those which come strictly under the heading of cardiovascular defectives. In them no cause whatever can be discovered. They represent a class which has had a bad start in life. Tracing the family history reveals nervous instability on the part of one or both parents, alcoholism or insanity. Often the mother is beyond the age of thirty when the boy was born. So many come from the farmer class that it would appear to be some environmental factor either affecting parents or child, or both, which produces tissues poor in resistance. These boys lack ambition. They do not think much about affairs in general. The work they do is desultory. Whenever they feel tired they stop for a while and rest. Such cases have had little schooling. Some appear stupid from lack of opportunity, but the stupidity for the most part is that of mentality of a low order, and apparent undevelopment of the brain. Such a case is the following:

Case 9.—H. C., recruit, aged twenty-one years, a farmer, has a family history negative as to nervousness or any insanity. He had very little schooling, the history showing that he was not particularly bright. In the hospital here he appeared so subnormal mentally that he was sent to the psychiatry staff for examination. Nothing definite was found except slow cerebration. His complaint dating back several years was of breathlessness on exertion and exhaustion and pain over the heart. He was also nervous and unable to sleep at night. He stood the graded exercises poorly. He never drilled since entering the army February 25, 1918. Physical examination negative except for rapid heart. Apex-beat within nipple line. Cannot hop one hundred times. Pulse before exercise, 108; after exercise, 160. In two minutes still rapid, 130. Dizziness, exhaustion and breathlessness complained of. Diagnosis: Irritable heart. Recommended for surgeon's certificate of disability.

The other class of case in this subgroup exhibits the same symptoms physically, but the mentality is above the average. It is no lack of opportunity for education in such cases illustrated above, but a real lack of ability to learn. This actually has no particular bearing upon the train of symptoms exhibited by these men. It only serves to group them into the two classes, in either one of which the same syndrome is brought out on slight exertion. The man with subnormal mentality necessarily never gets beyond a certain low scale in community life. His capabilities are necessarily so limited and his physical disability is so great that he has not the will to overcome his physical defects and force his brain to act. In

the struggle for existence he can just keep himself above water. The other class finds better living conditions, better pay provided he can obtain a position which supports him without the necessity of physical exertion. Such a case is the following:

Case 26.—L. C. B., recruit, aged twenty-five years, is a clerk by occupation. His father has had nervous headaches for years and his mother's health is only fairly good. He was sick in bed for the greater part of his childhood because of nervousness and missed a large part of his schooling. He had no difficulty in learning when he was in school. Five years ago, while at a show, he became unconscious and remained in a stupor for three days. It was said to be nervous prostration. He has always suffered from headaches and has never been able to exercise on account of exhaustion, breathlessness and headaches. He has been able to keep a position as city clerk, where the work is very light and not very steady. He is not able to work every day. On examination he appears to be a robust young man. Lungs, heart and abdomen show no abnormalities. Slight apical cardiorespiratory murmur is present. Sitting quietly, pulse 100. After hopping exercise, pulse 160. There were breathlessness, sweating hands, precordial pain, exhaustion, dizziness. Two minutes later pulse still fast, 130. Blood-pressure normal. Diagnosis: Irritable heart.

The second group containing the subheadings hyperthyroidism and exophthalmic goitre is too well known to need extended comment. The symptoms complained of by these men differ only in degree from those presented by the men with irritable heart. The important point to bear in mind is that these cases besides having tachycardia have also tremor of the extended fingers, lagging of the upper lids when looking quickly down and often poor convergence at near vision. Besides, as we have shown elsewhere, the blood-pressure in these cases is usually raised, whereas the blood-pressure in the cases of irritable heart is normal or inclined to be slightly below normal. The blood-pressure is raised in the hyperthyroidism-exophthalmic goitre group, and normal or below normal in the strictly irritable heart group. Diagnosis between these groups is not always easy nor is it always possible. One competent examiner will classify a case as one of irritable heart, an equally competent examiner will classify the same case as hyperthyroidism. The distinction appears to the writer to be valuable only in so far as the latter is a potential acute exophthalmic goitre. I do not believe there is any emotional shock violent enough to bring out Graves's disease in a normal man.

There is one difference which we discovered between the cases of true irritable heart (effort syndrome) and the cases of hyperthyroidism. That was the response to graded exercise. The former responded poorly. The latter were usually able to perform the setting-up exercises up to D,[30] with no subjective symptoms. The

tachycardia was often the only sign of abnormal reaction. Occasionally the tremor of the hands was increased.

In this group we may suppose some abnormality of the internal gland secretion. The relationship between the adrenal and thyroid glands appears to be a close one. We have proof that in states of anger, fear or other great emotion the adrenal secretion is suddenly greatly increased. The thyroid gland is powerfully stimulated to activity and metabolism is increased. This necessitates more rapid blood circulation and consequently more rapid heart action. It has been shown that the metabolism of patients with Graves's disease is greater than that of individuals of similar size, age and weight. The hyperthyroidism cases are after all only mild forms of Graves's disease. Some even call them Graves's disease, preferring not to use the term hyperthyroidism, which connotes increased thyroid secretion. As a matter of fact it is not universally admitted that hypersecretion of the gland takes place. There can be no doubt that the condition is a result of some aberrant functioning of the gland, whether alone or in response to some stimulation from some other gland of internal secretion. Until further light is thrown on the subject we shall have to content ourselves with hypotheses and speculation.

Group C. In this group are placed a number of diseases which cause, in the victims, symptoms so like the effort syndrome that only the most painstaking observation and examination will serve to make a correct diagnosis. Foremost among this group of diseases is pulmonary tuberculosis in the incipient stage. When patients have largely symptoms of the absorption of tuberculotoxin without very definite physical findings, the problem of diagnosis is a difficult one. Our cases were always examined by at least two men, and they were examined often when any doubt existed. The men were sent to the hospital because of persistent tachycardia, that being the objective finding which was most evident. They were placed in the group of cases under observation. The temperature, pulse and respiration were taken every three hours and they were exercised by the drill instructor. By this means we were able to sort out the cases of tuberculosis from the other cases with tachycardia by observing the rise in temperature following exercise and the development or increase of physical signs. The following case illustrates this point:

Case 15.—L. L., recruit, aged twenty-two years, complained of loss of weight and exhaustion on slight exercise, with some dizziness and precordial pain. He had gradually developed these symptoms within six months. His family history was negative and his past history revealed no serious illnesses. He had always been healthy and able to work. On examination there were slight signs of infiltration at the left apex. Rales were variable. Roentgen-ray plates showed slight haziness at the left apex. There was no cough and

no sputum. Even the slightest exercise caused him great distress and the temperature taken from twenty to thirty minutes after the exercise always showed a rise. The morning temperature was subnormal. Frequent examinations, the rise of temperature following exercise and his exceedingly poor response to exercise led us to the diagnosis of incipient pulmonary tuberculosis. His exercise response was far more severe than any of the cases of irritable heart.

I feel sure that hookworm disease and early Hodgkin's disease would show the same effort syndrome. I have no case histories to prove my contention. I have only recollection of symptoms complained of in patients seen in civilian practice. Uncinariasis is easily diagnosed. Early Hodgkin's disease is not so easily detected.

Chronic focal infections also may show typical effort syndrome. I have observed no cases in my studies, but I agree with those who make this assertion. I have not seen the removal of tonsils or the opening of nasal sinuses or the cleaning of apical tooth abscesses cure cases which had the effort syndrome, although I have no doubt that such cases do occur and such pathological conditions should always be kept in mind so that gross errors in diagnosis are avoided. I have seen bronchial asthma, cirrhosis of the liver and chronic malaria in patients who had effort syndrome and tachycardia. These patients were much improved under treatment. Those with the last-named disease went back to duty.

Etiology. We do not know why certain healthy, even robust-looking men have this strange inability to respond as normal persons do to a slight amount of physical exertion. They are always in the condition of a normal man just convalescing from a severe illness. No wonder that they lack ambition to overcome obstacles and are passed in the race of life. In the history of the cardiovascular defective certain points may be emphasized. The first is the parental history. These men do not have a fair start. One or both parents suffered from nervousness, chronic headaches, insanity or were alcoholic in 52.5 per cent. of the cases. Practically all the men dated their symptoms into childhood. "As long as I can remember" was a frequent response to the question, "How long have you had these symptoms?" In only 50 per cent. of my cases was there a definite time set, which followed some infectious disease. The other 50 per cent. could set no time of onset nor could they say that infectious disease had any relation to the symptoms. The fact that so many of these defectives come from a neurotic parentage and are brought up in an environment surcharged with bodily complaints renders them introspective of their small ailments. Eventually their mental states so dominate the somatic functions that trivial sensations are magnified to an extent which causes them acute suffering. Should this take the form of palpitation of the heart, sensible to them, and should some doctor tell them they have heart

disease and treat them for it, the cases become practically helpless hypochondriacs. The following is illustrative of this group:

Case 30.—F. C. J., recruit aged twenty-five years, was a big, healthy looking fellow, but always had a worried look. He entered the army at this post July 11, 1918, admitted to the hospital July 16. His mother was neurotic, a fussy woman; his father was well. Several brothers and sisters were all well. As a child his mother said he was always nervous—never could play with the other children, as he became easily exhausted. He was evidently nagged during his youth. When he was old enough to work he was taken away from one position after another as soon as he made any complaint. Finally, about four years ago, his mother took him to a doctor who told him he had serious heart disease and treated him for it up to the time he was drafted into the army. He was married and was supported by his wife and mother. He could not do any work. He complained of inability to perform even the slightest exercise. He was obsessed with the idea that he had serious heart trouble, his mother and wife abetting him in this belief. On slight exertion his heart pounded, he had precordial pain, dizziness, headache, breathlessness and exhaustion. On physical examination he was tall, well built and a strong looking man. The pulse was always rapid. The heart was slightly enlarged. There was a soft, short systolic murmur at the apex not considered to be organic. The lungs were negative. The blood-pressure was 116–80. Exercise response was poor. There were rapid pulse, pounding heart and anxious expression. The vasomotor instability was marked. Diagnosis: Irritable heart, hypochondriasis.

Frequently in the histories of these cardiovascular defectives there will be fainting spells, attacks of dizziness when everything gets black, or there will be convulsive seizures and unconscious periods lasting for hours or days. Attacks of nervous prostration in children are not uncommon. Such abnormal conditions can only occur on a marked neuropathic basis. The cases which date their symptoms from some infectious disease have not given such histories. They complain only of the symptoms which follow exertion and which they are certain were not present previous to the illness. In these cases one may feel reasonably sure that the myocardium has been permanently damaged. Dilatation of the heart following slight exertion will account for all the symptoms of the effort syndrome.

When no cause can be assigned we are forced back upon the term "constitutional inferiority," which explains nothing. It simply states a fact with which all are familiar.

Graded Exercise. Graded setting-up exercises were begun, with the idea of hardening the men so that they could do full duty. It was thought that a certain number of men with the effort syndrome could be gradually strengthened. Before the cases were fully recognized at the examining barracks some men were accepted

who had mild symptoms, with slight tachycardia at rest. These men were put out at the usual setting-up exercises. Some fainted, some grew so dizzy that they had to be excused, some managed to get through a day's exercise, but were exhausted and bed-ridden for the next day or two. Hence it was felt that a more gradual break-away from their sedentary civilian lives would render these men less liable to break down under violent exercise. In this we were disappointed. In no case of true effort syndrome was there any betterment even after days of the slightest exercise. Any attempt to go from very light to a light exercise brought on symptoms more violent than before. On the other hand, there were cases diagnosed irritable heart at the examining barracks who were accepted for limited service. Two months later at the examination for demobilization many of these men had normal cardiovascular response to exercise. In every case in which the condition had apparently cleared there were absolutely no symptoms complained of at any time in the man's life except the pounding of the heart following violent exertion in men who were unaccustomed to exercise. They were clerks or others who led sedentary lives. On the contrary, the cases which still revealed the effort syndrome were those who had complained of precordial pain or dizziness with the pounding heart after exercise and previous to their induction into service. These men without exception stated that they had not been able to stand the light drill and had been working the past two months as clerks. This lends weight to the point that in the history of the man there must be one or more of the cardinal symptoms of the syndrome. The tachycardia alone is not sufficient for diagnosis. The pulse may remain rapid longer than two minutes after the usual test exercise of hopping one hundred times on one foot. There may even be great exhaustion present, but if there have been no symptoms which careful inquiry has elicited, one is not justified in diagnosing the case irritable heart.

The temperature of every patient was taken twenty minutes after exercise. The cases of pulmonary tuberculosis could be picked out by the temperature reaction. All the men exercised were those upon whom a definite diagnosis had not been made. It was found that cases could be sorted into groups according to their response to exercise. For example, the cases of suspected hyperthyroidism responded best to exercise. The pulse-rate was not so high, there was no rise of temperature and symptoms were not so severe, as a rule. Further, they often were able to increase exercise without discomfort. The cases of effort syndrome showed no improvement under exercise. They often grew worse and had to be excused. The temperature was not raised in these men. The cases of suspected pulmonary tuberculosis usually responded badly to exercise. They became easily exhausted, and showed marked breathlessness. The temperature was always raised from 1° to 3° after exercise, and there

were frequently rales heard over one or both apices where none had been heard before. Graded exercise, therefore, is not only of therapeutic value, but it becomes of real diagnostic value under certain circumstances. Further, in the cases of effort syndrome when the symptoms dated definitely from some serious illness, often ten to fifteen years previously, there was frequently demonstrable an actual displacement of the apex-beat to the left following the exercise. This could have but one meaning and hence was interpreted as dilatation of the left side of the heart.

PROGNOSIS. As has been stated, it has not been possible for us to benefit these cases by graded exercise. After some experience with the cardiovascular defectives we rejected them after studying them in hospital in order to be sure we were making no mistakes in diagnosis. Those with marked psychoneurotic state we consider to be hopeless "spongers" on their families or on the communities in which they live. Other cases who have been making a living at farming or clerking we see no reason to predict any bad fate for. As long as they recognize their limitations and live always within them they should have no difficulty in keeping well and free from distressing symptoms, chiefly palpitation and precordial pain.

SUMMARY. There is a class of young men of usually healthy appearance who nevertheless suffer from a group of symptoms following mild exercise characterized by breathlessness, precordial pain, dizziness, palpitation and exhaustion. There also may be headache, sleeplessness, cold, clammy hands and feet and profuse sweating. These men might never have been discovered except for the army draft, which caused thousands of young men to be examined physically. These men have no complaints, as a rule, which lead them to seek medical advice. They find that they are better able to make a living at light or sedentary work than at hard work, so they drift into the lighter occupations. The majority are surprised when told that there is something really the matter with them, although they have recognized the fact that they cannot take the violent exercise which other men of their acquaintance can take. A certain number are taken by their parents to a doctor, who may diagnose heart disease or neurasthenia.

There is no common etiological factor among the true cardiovascular defectives—no cause can be found except a constitutional inferiority, a poor quality of tissue which must be supposed to account for the syndrome. Among others, certain chronic diseases or the result of severe acute illnesses are responsible for the syndrome.

When there is a definite pathological basis, such as pulmonary tuberculosis or chronic focal infection, etc., cure of the disease causes the effort syndrome to disappear. Cases resulting from infectious disease or based upon constitutional inferiority do not improve in our experience.

Exercise was valuable in determining the fitness of the men for

military duty and in giving data in the diagnosis of certain cases suspected of being tuberculosis. The cases were studied primarily for the purpose of sorting the fit from the unfit in military service. Happily, no longer this must be done. However, the knowledge gained in observing these cases is not devoid of value to us in civil life. It should materially assist us in handling a group of cases hitherto poorly classified and insufficiently studied.

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A CASE OF PERFORATED GASTRIC ULCER, WITH ABSCESS FORMATION; PERFORATION THROUGH THE LUNG, WITH SPONTANEOUS RECOVERY.[1]

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Cases of perforation of the stomach and duodenum leading to subphrenic abscess, w th rupture through the lung, are of sufficient rarity to be of interest. The patient, Mr. W. P. G. aged fifty-one years, was first seen in consultation with Dr. O. N. Duvall on April 5, 1917. His family and personal histories were entirely negative and unimportant, except as related to his gastro-intestinal tract.

The patient had complained of gastric disturbance for the past twenty-five to thirty years. During this period there was frequent indigestion, consisting mainly of fulness after meals and belching. For the past eight to ten years the attacks of indigestion were periodic, lasting for three or four weeks to several months at a time. These attacks were characterized by pain in the stomach appearing two hours after meals, more marked after solid food, which were

[1] Read at the meeting of the Association of American Physicians, Atlantic City, June 17, 1919.

relieved by the use of soda or by rest in the recumbent posture. There were eructations of acid matter, and pyrosis was frequent. Hunger pains were often present, which were relieved by food, the pain recurring two or three hours later. There were periods of six months or more, during which the patient enjoyed perfect health, free from all digestive symptoms. He was always constipated; was frequently nauseated; vomited at times; however, he had at no time vomited blood or food eaten the day previously, nor had he passed tar-colored stools. The appetite was good; there was no history of jaundice. The patient complained of hemorrhoids. He had had lumbago and was affected with nocturia, micturating once during the night; there was no history of swelling of the feet or eyelids; no dizziness. The patient denied having had lues or gonorrhea.

Present Illness. After some weeks of indigestion, of such a character as has already been described, the patient was suddenly seized with severe agonizing pains over the left upper abdomen, which required the administration of two hypodermic injections of morphin for relief. At that time the abdomen was distended and there was present a distinctly tender epigastric area. The following day he developed dull pain in the left kidney region, which radiated toward the epigastrium. This pain persisted for ten days and was accompanied by a temperature ranging between 101° to 103°. He developed a cough and hiccoughing, which were shortly followed by a purulent expectoration; he expectorated during the first day about one quart of pus. When the expectoration began the temperature receded and the pain became greatly diminished. At this stage the patient was admitted into the Union Protestant Infirmary (April 6, 1917).

Examination. The patient is a thin, poorly nourished individual, with much respiratory discomfort and a facial expression of distress. The skin and mucous membranes were pale; the ears and eyes were normal. The alæ nasi moved rapidly in respiration. The tongue was coated; there was a marked pyorrhea alveolaris.

Chest. The physical findings of the chest were negative, except that there was some impairment of the percussion note on the right side over the region of the scapula. However, on auscultation nothing abnormal could be discovered in this region. The heart was not enlarged; the sounds were clear; there were no murmurs.

Abdomen. The abdomen was somewhat distended. The recti muscles were spastic. There was a distinctly tender area in the epigastrium as well as tenderness in the left lumbar region, over which there was a burn caused by hot applications to that region. The liver extended one finger's breadth below the costal margin. No masses were felt anywhere. The genitals were normal; there were no glandular enlargements. The reflexes were present and were equal and active on both sides.

Blood examination: Total leukocyte count, 11,900. Differential count: Polynuclears, 70 per cent.; small mononuclears, 25 per cent.; large mononuclears, 4 per cent.

Urinary Examination. The urine had a specific gravity of 1022; presented a trace of albumin, but was otherwise negative.

Roentgen-ray Examination. Stomach: High stomach, rapid expulsion, defect at pyloroduodenal junction, revealing an ulcer at this area.

Chest: No emphysema or thickened pleura. Dilatation of bronchi at bases showed bronchiectasis. Cloudy infiltration below the right clavicle.

NOTE.—Since admission into the hospital the patient expectorated about one pint of pus the first day, the quantity decreasing each day since that time; finally, on April 11, he expectorated but 50 c.c. of pus, and on April 12 there was no further expectoration. The pus was thick and creamy and of a putrid odor, containing colon bacilli as well as streptococci in abundance.

On admission the patient's temperature was 100°, which gradually fell, so that after April 12 it remained normal. His appetite improved and he began to feel much stronger. He left the hospital on April 12 greatly improved in health, and has remained well since.

It is clear that the patient must have had a gastric ulcer, persisting over a long period of time. This became evident from the long ulcer history, with periods of remission, as well as from the definite roentgen-ray signs of ulcer, which were revealed at the time of his entrance into the hospital. The sudden onset of abdominal pain, requiring two hypodermic injections of morphin for relief, indicated the onset of the perforation, which was followed by fever, the formation of subphrenic abscess and finally a perforation through the lung, with the expectoration of pus. After the abscess was thoroughly evacuated the patient made a spontaneous recovery.

In an extensive monograph published in 1894 Maydl reports 179 cases of subphrenic abscesses, the stomach and duodenum being the source of infection in 35.

Subphrenic abscess may be either intraperitoneal or extraperitoneal, the latter being more frequent on the left side. Since the falciform ligament acts as a firm wall the abscesses are found usually on one side only. The right-sided ones are between the diaphragm and the liver. The left-sided ones have the diaphragm above and below, and for boundaries some part of the stomach, spleen, transverse colon and left lobe of the liver. The origin of the infection may arise from any one of these organs. The abscess appears as an encysted localized peritonitis and the cavity may be very small or large enough to hold several liters of pus or pus with gas.' The pus may be thick or thin, putrid or free from odor, or colored with blood. The gas may arise from the opening to the

organs, which may contain gas or may be due to the gas bacillus of Welch.

In Maydl's series of 179 cases, of which 47 contained gas, 20 were due to perforation from the gastro-intestinal tract, 18 to secondary perforation (16 into the lung and 2 into the gastro-intestinal tract) and 9 to the gas bacillus, no perforation having been observed. The organisms most frequently observed in the pus are the tubercle bacillus, staphylococcus and the colon bacillus.

Osler notes that the presence of the colon bacillus in the pus indicates the gastro-intestinal tract as the origin of the infection. If the abscess is not disturbed it is liable to perforate the diaphragm infecting the pleural cavity and lung, and complete evacuation may take place through the lung; thus spontaneous cure might be effected, as was observed in our case.

In perforation of gastric ulcers producing subphrenic abscesses the symptoms may develop slowly, but, as a rule, the pus accumulates rapidly and the symptoms are usually exceedingly acute. There is often a sudden severe pain in the epigastrium or hypochondrium radiating to the shoulders, with marked dyspnea due to pressure on the diaphragm. There is usually present, in addition, vomiting, hiccough and marked weakness and acceleration of the pulse. Fever with chills and sweats are not uncommonly observed. Perforation of the diaphragm and rupture into and through the lung next occurs, with complete evacuation through a bronchus.

There are but four cases recorded similar to ours in which perforation from a gastric ulcer was followed by rupture through the lung.

CASE I.—Leyden.[2] The patient, aged seventy years, was suddenly taken with acute abdominal pain. There appeared to be some obstructive condition of the bowels, as it seemed impossible to produce a bowel evacuation; finally, after three days, the bowels moved, but fever then appeared, with chills and dulness on the right side of the chest up to the middle of the scapula. There was then a sudden expectoration of a large quantity of bloody fetid pus.

CASE II.—Juliusberge.[3] A. B., aged forty-three years, was treated for rectal hemorrhages which had weakened the patient very materially. He also complained of digestive discomfort, loss of appetite; pressure and fulness in the region of the stomach, especially after meals; belching; pain and flatulency. The patient was suddenly taken with hematemesis and pain in the stomach and fainting. On examination the epigastrium was found markedly distended and a mass was formed in this region; chills and fever appeared; finally the patient expectorated a large quantity of pus.

[2] Ztschr. f. klin. Med., i, 320.
[3] Berl. klin. Wchnschr., 1874, p. 643.

CASE III.—Neusser.[4] A female patient, aged thirty-seven years, observed a swelling in the abdomen above the umbilicus. In addition there were numerous digestive symptoms, loss of appetite, green stools and pain after food. A cough appeared and was finally followed by the expectoration of pus. The patient died and at autopsy a perforated gastric ulcer was found, leading to a pus cavity in the lungs.

CASE IV.—Nowack.[5] A maid, aged nineteen years, had frequently been affected with gastric disorder. She was suddenly seized with sharp pain in the lower abdomen. The pain increased and the abdomen became swollen. The patient began to vomit and became very weak. The pain in the region of the liver increased; the pulse became rapid and weak and the temperature subnormal. A perforation of the stomach was diagnosed and an operation performed. From one to two liters of fibrinous fluid were found in the abdominal cavity. The patient died and at autopsy an abscess of the lung was revealed, produced by the perforated gastric ulcer.

LUMBAR PUNCTURE AS A FACTOR IN THE CAUSATION OF MENINGITIS.

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RECENT studies on experimental meningitis in the Army Neurosurgical Laboratory[42] have demonstrated that the release of cerebrospinal fluid during certain artificial septicemias in animals is followed by a localization of the infection within the meninges. The method employed in these investigations consisted in giving an animal an intravenous injection of a suitable dose of an organism whose pathogenicity for the meninges was known to be high. Following this, spinal fluid was withdrawn during the height of the septicemia, either by lumbar or cistern puncture.[43] Animals subjected to this procedure invariably developed a fatal meningitis. Control animals inoculated intravenously with similar or larger doses of the same organisms, and not subjected to lumbar or cistern puncture, remained normal and showed subsequently no evidences

[4] Wien. med. Wchnschr., 1884.
[5] Schmidt's Jahrb., 1891, Nos. 9 and 10.

of involvement of the central nervous system. This led naturally to the question of the possible clinical importance of such observations. Opportunity for the clinical investigation of the problem was afforded by the Surgeon-General of the Army during the fall of 1918 at Camp Jackson, S. C., where, through the courtesy of Major M. A. Barber, chief of the laboratory, and Major W. W. Herrick, chief of the medical service at the base hospital, much valuable material was made available.

It is quite evident that in any clinical series it is necessary to take the septicemias as we find them. As was demonstrated in the paper mentioned above,[42] upon the degree of intensity of the septicemia depends largely the probability of meningitis following lumbar or cistern puncture. For this reason it should not be expected that a clinical series will show the danger of such a procedure as conclusively as it was shown to exist in animals.

Clinical Observations. The objects of this field work were to ascertain the frequency with which cases of septicemia were subjected to lumbar puncture for diagnostic purposes, and also to learn, when the fluids resulting from such punctures were negative, what the final outcome of the case would be in respect to the appearance of meningitis. To accomplish this it was necessary to have blood cultures taken synchronously with the puncture or within a few hours of the time when it was performed, a procedure which was made quite simple by the coöperation of the bacteriologist of the laboratory, Lieut. E. B. Anderson. Examination of the spinal fluid was made immediately after its withdrawal, and consisted of the routine analysis in respect to character, cell count and differential, sugar and globulin content and cultural manifestations. A smear from a centrifugalized portion of the specimen was always made. The cultures were obtained from the centrifugalized portion also, in addition to which clear specimens were incubated separately. As soon as possible after the analysis the patient was examined in the ward and the subsequent clinical course observed at frequent intervals.

From September 25 until November 7, 1918, 93 patients were suspected of having meningitis and subjected to lumbar puncture. Of these a positive diagnosis of the disease was made in 38 instances from the spinal fluid obtained at the first puncture. The remaining 55 cases yielded clear fluids containing neither pus nor organisms, but among them there were 6 patients who, at the time of the primary puncture, had positive blood cultures. In 3 of these 6 the organism concerned was the meningococcus and in 3 the pneumococcus. Five of these patients subsequently developed meningitis, the one not contracting the disease being a case of pneumococcus septicemia, which eventually went on to recovery.

Pneumococcus Infections. Of the 4 cases of pneumococcus meningitis observed at the base hospital at Camp Jackson during

the period which this report covers, 2 developed the disease subsequent to withdrawal of clear normal fluid by lumbar puncture. The first of these patients, J. P., entered the hospital on September 30 with pneumonia. On October 5 his condition was noted as serious; three days later there was some stiffness of the neck, with tremor and unequal reflexes. His condition did not improve and on October 10 he was reported as being stuporous, with rapid respirations. Slight rigidity of the neck was present, but Kernig and Brudzinski were absent. A lumbar puncture was made, the spinal fluid obtained being clear and containing 3 cells per c.mm. Globulin was normal and sugar was present. Both smears and cultures of the fluid were negative. The opinion at the time was that the case was one of meningismus from toxemia of pneumonia, although the pressure of the spinal fluid was normal. On the day following this (October 11) there was a slight improvement in the patient's general condition, but a blood culture taken then demonstrated the presence of a Type IV pneumococcus. On October 12, the patient's condition remaining unchanged, a second lumbar puncture was performed. The fluid was again clear, contained 5 cells (no red blood cells) per c.mm., and was normal in all respects. Cultures were negative. Two days after this second puncture his condition became worse. He responded to questions intelligently, but had definite rigidity of the neck; Kernig and Brudzinski were marked and all reflexes were exaggerated. A third lumbar puncture at this time yielded a cloudy fluid containing 1200 white blood cells per c.mm. There was also a marked increase in globulin content, with absence of sugar. Both smear and culture showed the presence of the pneumococcus, which typed the same as that found previously in the blood. The patient died October 15 (the third day after the second puncture) and the autopsy showed a thick, purulent exudate over both hemispheres and with little reaction in the ventricles.

In this instance the patient was not only very toxic but also showed signs suggesting meningitis, so it is not surprising that a lumbar puncture was resorted to. In the following case, however, the clinical signs indicating such an exploration were absent and the relationship between the diagnostic puncture during a septicemia and a subsequent meningitis is clearly shown.

This soldier (Pvt. T.) was being treated for pneumonia, and early in the morning of October 23 the emergency night officer was called to administer to him for a headache. The officer detected what he thought to be the rash of a meningococcus septicemia on the patient's chest and sent for the ward surgeon on the meningitis service for consultation. This surgeon examined the man at 5.30 A.M. and found no evidence of meningitis or meningococcus infection, the rash having turned out to be typical acne. In order to be sure and satisfy himself, as well as the surgeon in charge of the case, of the correctness of the diagnosis, he made a lumbar puncture. The fluid

obtained was perfectly clear, contained but two white cells per c.mm. and no red cells. As a matter of routine (for no one suspected the patient of having a septicemia) a specimen of blood was taken for culture, which revealed the presence of a pneumococcus (Type I) infection. On the following evening (October 24) the patient began to show unmistakable signs of irritation within the central nervous system and a second spinal fluid withdrawn at this time (thirty-six hours after the first) gave positive evidence of meningitis, the infecting organism being the pneumococcus (Type I). Intraspinal therapy with the specific antipneumococcus serum was immediately instituted without effect and the patient died on the morning of October 25. Autopsy showed a typical pneumococcus leptomeningitis, with secondary hydrocephalus.

The two cases just recorded indicate the possibility of the removal of cerebrospinal fluid acting as a factor facilitating the infection of the meninges from the blood stream. In both of these patients an initial normal spinal fluid was obtained at the time of a positive pneumococcus septicemia. Subsequently, meningitis, caused by the same organisms circulating in the blood stream, occurred in both patients; death followed in twenty-four to forty-eight hours. In the first case the diagnostic puncture was made because meningitic symptoms were present; in the second the obvious purpose of the puncture was to complete the clinical study. On account of the absence of all signs of meningeal involvement at the time of the puncture the second case affords a close analogy to the observations made in this laboratory on experimental animals.

Meningococcus Infections. The appearance of a small epidemic of meningococcus infections at Camp Jackson during the latter part of October furnished material for a clinical consideration of the disease in a variety of its forms. Due to the skill in diagnosis acquired by the officers of the medical service at the base hospital and the watchfulness maintained by the regimental surgeons a relatively large number of the septicemic type of these infections was detected; many of the cases exhibited no clinical evidence of meningitis at the time the septicemia was diagnosed. Since certain of these patients were punctured at a time when the meninges were free from infection, opportunity was afforded to observe any relationship which might possibly exist between the performance of diagnostic lumbar puncture and the subsequent localization in the meninges of such blood stream infections. The influence of serum therapy in this relationship could also be studied.

There were among the cases observed three of the fulminating type of meningococcus septicemia. All of them were alike in that onset was sudden and the course of short duration—fifteen to twenty-four hours. Each patient was covered by a characteristic purpuric rash, so ably described by Herrick,[16] but in none of them were there symptoms indicative of irritation within the central

nervous system. That an actual meningitis did not play an important part in the disease is demonstrated in part by the pathological study of the spinal fluid of one of these patients, a nurse, who died within twenty-four hours after the manifestation of the first clinical signs of systemic infection. A diagnostic lumbar puncture was performed just forty minutes before the patient died. The fluid then contained Gram-negative diplococci, with very slight increase of cells of the polymorphonuclear and mononuclear types (12 per c.mm.). Although an early meningitis was undoubtedly present it was in no degree comparable with the severity of the septicemia, which in this instance may be considered as the cause of death. Unfortunately no autopsy was procured.

In the second case, that of a soldier, E. A., the same picture was present; this man also died within twenty-four hours after the onset of his illness. During life no lumbar puncture was made, but a specimen of fluid obtained three hours postmortem contained but twelve cells with sugar and globulin normal. The culture was contaminated and revealed among other bacteria a colony of Gram-negative diplococci which did not grow on subculture sufficiently to type. No gross lesion of the central nervous system was seen at autopsy. The histological findings in the meninges were limited to an infiltration, with large mononuclear cells (arachnoid proliferation, Essick[9]), with scattered free red blood cells. The ependyma was normal.

The third case of the series, W. H., is perhaps the most interesting, for in it we have an excellent control for the other two. On admission, October 2, 1918, at 5.30 P.M., the patient had general aches and pains in the back, legs and joints, associated with headache and sore throat, the symptoms having started the day before. He was perfectly conscious and had no signs of meningeal involvement. The skin of the whole body, especially of the face and upper extremities, was very thickly sprinkled with ecchymotic areas. There were similar ecchymoses on the conjunctivæ. The patient objected to being moved on account of the extreme soreness of the muscles of the extremities. Neither stiffness of the neck nor Kernig was present. His temperature was 103° and his pulse 112. Blood culture on admission showed meningococcus and a white blood count made was 11,000. At the same time a diagnostic lumbar puncture was done. The spinal fluid was clear and contained but four cells per c.mm. (no red blood corpuscles.) The globulin content was not increased (Noguchi) and Benedict's solution was reduced. Repeated smears from the centrifugalized portion of the fluid showed neither pus cells nor meningococci, and cultures of the fluid were negative. No intraspinous serum was given. During the night the patient was given 160 c.c. and later 140 c.c. of Serum V (Rockefeller) intravenously. By 8.30 A.M. the next day he was markedly prostrated. Orientation continued normal, and at 10 A.M., though he was deeply

prostrated, he could be aroused, when his responses were still intelligent. His neck was not stiff, but all the deep reflexes were abolished. The patient died at 11.30 A.M. The pathological examination of the brain showed the presence of an early meningitis over the cerebral hemispheres.

These cases of fulminating meningococcus septicemia correspond in all respects to those reported by numerous authors and demonstrate the truth of Sophian's[37] statement that the clinical observations and postmortem examination bear out the fact that it is the general sepsis that kills. The third case of the above group represents, moreover, a possible relationship between the release of cerebrospinal fluid during a septicemia and the subsequent meningitis.

The next question to determine was whether such septicemias can go on to recovery without showing meningeal involvement, and though there are many such illustrations to be found in the literature, the following personally observed case (F. G. G.) is of interest. This patient was a convalescent from pneumonia and had had a normal temperature for five days. At 8 o'clock on the evening of October 25 his temperature suddenly rose to 103°, having been normal throughout the day; a morbilliform rash developed and the conjunctivæ became injected. Otherwise the patient did not feel badly and there were no signs of meningitis, although his appearance suggested a meningococcus septicemia. A blood count at 9.30 P.M. the same evening showed 23,000 white cells and a blood culture demonstrated Type IV (normal) meningococcus. Twelve hours later the man was seen again, when his temperature was 98°, pulse 68 and a second blood culture taken at this time remained sterile. Antimeningococcic serum was subsequently given intravenously, but there was never a recurrence of the fever, and the patient was not subjected to lumbar puncture.

In these few observations it was quite clearly demonstrated that the meningococcus, like other blood-stream invaders, may vary enormously in its pathogenicity, and even when present in its most virulent form, the fulminating type, the meninges may very well escape being affected.

It is also conceivable that under some circumstances in which the organism is attenuated the meningococcus may actually reach the meninges without producing an infection. This point is well illustrated by a case seen by us. This patient had a meningococcus septicemia, and though he showed no clinical signs of meningitis, he was subjected to lumbar puncture for diagnostic purposes; the puncture was made, however, after he had already received intravenous serum treatment. The spinal fluid obtained had a slight blood contamination, but was otherwise normal, except that in the culture (blood-agar plate) a single colony of meningococcus was found. This was the only lumbar puncture performed and the patient did not develop meningitis, although the organism may have

been in the subarachnoid space at the time the spinal fluid was withdrawn. The presence of the colony of bacteria in the culture was felt to be a result of the blood contamination. In any event it is hardly conceivable that the meninges in this instance could have escaped infection, for if the organisms were not already present within the subarachnoid space at the time of puncture there was the possibility of indirect and direct invasion from the blood stream. Such a localization of the systemic infection might be expected to follow the release of spinal fluid, and there was, in addition, the obvious pathway for direct contamination resulting from vascular trauma during the operation, as evidenced by the presence of red blood cells in the spinal fluid. That meningitis did not develop may be explained by assuming that the organisms had already lost their virulence, probably as a result of the previously instituted intravenous serum therapy. Furthermore, that the timely administration of intravenous serum therapy may result, not only in lowering the virulence of the meningococcus, but in actually killing the organism in the blood stream before it has a chance to localize in the meninges, is probably true also. At Camp Jackson we never expected a positive blood culture after the first dose of serum given intravenously. Two cases which came under our observation on the service of Major Herrick, at Camp Jackson, may be cited in point; in order to save time in treatment they were given serum intravenously as soon as the clinical diagnosis of meningococcus septicemia was made. Within the next twelve hours after the serum had been given, specimens of blood and spinal fluid from both cases failed to show the presence of organisms and both patients went on to recovery without developing meningitis. Similarly, a third case, diagnosed clinically as a meningococcus septicemia, was given serum intravenously before blood and spinal-fluid specimens could be obtained. It was not until two weeks later when the patient came down with recurrence of the infection, during which he developed a typical meningitis, that any positive laboratory data were obtained on the case. The early use of intravenous serum successfully overcame the infection in the blood stream of two of these cases before the meninges were affected and without the intraspinous therapy. It is not known where the third patient was harboring the focus of infection which was responsible for his relapse. The blood stream was thought to have been cleared of microörganisms and serum therapy had consequently been discontinued a week prior to the recrudescence. The patient never showed any signs of irritation of the central nervous system before the development of the meningitis subsequent to his relapse.

In the cases so far considered the study of the relationship between a diagnostic lumbar puncture during a meningococcus septicemia and any subsequent reaction displayed by the meninges has been complicated by several factors, namely, the fulminating

type of the blood stream infections in the first cases and the early intravenous treatments with serum in the others. It was with great interest therefore that two cases of meningococcus septicemia which were punctured for diagnostic purposes during a period of blood stream invasion, before serum was administered, were followed.

The first of these, a soldier, J. J. S., was recovering from lobar pneumonia and his temperature, normal since October 4, suddenly rose to 103° at 11.00 P.M. on October 20. His pulse at the time was 120. He said that he had pain in his legs and a slight headache for the past three days. His neck was not stiff and his reflexes were all normal. There were on his abdomen and back a few small spots which looked like flea-bites, but there were no petechiæ. The following morning his temperature was 102°, but his appearance was normal, and he said that he felt well. At this time there were many small petechiæ on the chest and upper arm. There was slight Kernig but no rigidity of the neck. A blood culture taken at this time showed meningococcus, Type IV. A lumbar puncture was done at the same time and the fluid obtained was clear, contained 13 white blood cells and 600 red blood cells per c.mm. The globulin was negative and Fehling's solution was reduced. No organisms were seen in the smear from the centrifugalate and cultures of the fluid remained sterile. No serum was given intraspinously at this time, but intravenous treatment was started shortly afterward. On the second day (October 22) the signs of meningeal irritation were marked and a second lumbar puncture at this time yielded a cloudy fluid in which the pus cells formed a thick sediment. Smears from this sediment showed pus cells in quantities, as well as intracellular and extracellular Gram-negative diplococci. Intraspinal serum treatment was then instituted along with the intravenous treatment, and with this the patient made an uneventful recovery.

The second case, Ed. W., came in on October 2, 1918, with influenza and developed a bronchopneumonia on October 7. He was making satisfactory progress and was running a normal temperature until 8 P.M. on October 18, when it rose to 104°. He developed a macular rash which disappeared on pressure. He had no rigidity of the neck and no headache, but had vomited and was uncomfortable. Blood culture at this time gave meningococcus, Type IV (normal). Lumbar puncture was done at 10 P.M., and the spinal fluid was clear, containing 20 white and 15 red blood cells. Noguchi's test indicated no increase in globulin. Benedict's solution was reduced and cultures were negative. Smears of the centrifugalate of the spinal fluid showed no polymorphonuclear leukocytes or organisms. The next morning at 10.20 the spinal fluid was cloudy and contained 4320 white blood cells, and numerous organisms were seen in the smear. Clinical signs of meningitis were present and the patient was semiconscious. He died on the morning of the second day (October 20). Autopsy demonstrated a widespread meningitis

covering both cerebral hemispheres, with beginning invasion of the ventricles.

In both of these last cases there was some blood contamination of the spinal fluids at the first puncture, and it might well be said that infection in each of them, if the result of the puncture, should be attributed to direct infection of the meninges through injury of a bloodvessel by the exploring needle. This possibility must, of course, be kept in mind, but experimentally it has been found that in the production of meningitis by the release of spinal fluid during septicemias the direct infections from vascular injury at the site of puncture can be excluded as a factor. In the second case (Ed. W.) the slight increase in white cells in the first fluid may be interpreted by some as an indication that an early meningitis was already present. But an increase in the mononuclear content of the cerebrospinal fluid, though not always manifest, is nevertheless so frequent an occurrence in most febrile and toxic conditions that it is a question, when the phenomenon is present, whether it should not be looked upon as a normal, probably defensive reaction of the meninges during such conditions. A case illustrating this reaction presented itself the same evening that the patient here referred to was examined, and concerned itself with a colored soldier, who on account of certain general symptoms was suspected of having meningitis. A lumbar puncture was performed and the fluid was found to contain 30 white cells per c.mm., all mononuclears, but no organisms. Two days later the man died and at autopsy bilateral bronchopneumonia and peritonitis, but no meningitis were found. A second specimen of spinal fluid obtained immediately after death contained 27 white cells per c.mm., all mononuclears; cultures remained sterile.

With the exception of the first case of pneumococcus infection all of the patients cited thus far were free from clinical signs of meningeal involvement at the time they were first punctured. Such punctures were not made to institute prophylactic measures, for serum was not injected at the time, in accordance with a rule, established at this hospital, that such therapy was only to be administered when the first fluid obtained by lumbar puncture was found to be pathological. This precaution was taken following the published observations of Flexner and Amoss[10] on poliomyelitis, and later of Austrian[3] on meningococcus septicemias with respect to the effect of the introduction of serum into the subarachnoid space upon the localization of a blood stream infection in the meninges. If the cases of meningococcus infection are considered it will be seen that, with the exception of the fulminating case, those who had received intravenous serum therapy before lumbar puncture was done, showed subsequently no evidences of meningeal infection (without serum having been given intraspinally), whereas those who were punctured early, before measures had been taken to destroy or attenuate the organism present in the blood stream, developed meningitis the following day.

In the first group the withdrawal of spinal fluid served no other purpose than to support the clinical diagnosis that the meninges had not been invaded, and so far as beneficial result was concerned the procedure could very well have been dispensed with. In the second group, since positive signs of meningitis were lacking, delay in lumbar puncture until intravenous therapy had been started would have been logical; under the circumstances no good was accomplished beyond the substantiation of a fact which was already clinically apparent. On the other hand, the subsequent development of meningitis suggests rather strongly, in view of the ease with which experimental meningitis is produced by similar procedures, that actual harm was done.

Review of Literature. A survey of the literature has revealed that meningitis not infrequently occurs shortly after normal spinal fluid has been obtained by lumbar puncture. In these reports the interpretation of the findings has varied greatly, but in no instance has the withdrawal of spinal fluid itself been suggested as a possible cause of the subsequent infection in the central nervous system. Unfortunately, many of the case histories do not contain records of blood cultures. Even without such data, however, the relationship between the diagnostic puncture and the pathological changes in the meninges following it, is significant enough to suggest the importance of the withdrawal of spinal fluid as a factor in the localization of infection within the central nervous system.

Arnold Netter was one of the earliest to appreciate the importance of the relation of blood stream infections to meningitis and sought in animal experimentation the solution of this relationship. As early as 1887 he was able, after cauterizing the brain surface through a trephine opening, to cause a localization of the pneumococcus in the meninges of rabbits following intrapulmonary inoculation of the organism. Following this observation, Netter[24 25] has repeatedly emphasized the importance of blood stream infections as antecedent to meningitis. As a result his attention has been particularly drawn to a study of early meningitis and the condition of the spinal fluid in the first stages of the disease. Commenting on these early fluids, obtained during the first twenty-four hours of illness, this author says that three of the four observed were clear, contained flocculi of fibrin and were rich in organisms but poor in cells. The second fluids were always cloudy. On the other hand, in 6 cases out of 11, punctured for the first time more than two weeks after the onset of illness, the fluid was clear, but the Weichselbaum organism could not be demonstrated either by direct smear or culture in 5 of them. The second fluids, obtained twenty-four hours later, contained both pus cells and organisms. Unfortunately there is no record of blood cultures in these cases, although with the long duration of symptoms without earlier localization in the meninges, one is almost justified in assuming a general infection to have been present. Commenting

on this same type of case in 1911, Netter and Debre[27] note that in contrast to the impossibility of finding the Weichselbaum organism in clear fluids in which the cells are either rare or absent, the diplicocci are easily found after the second puncture, when the fluid becomes cloudy and contains polymorphonuclear cells. As a result of such observations Netter has repeatedly, with Debre[26] and with Salamier,[28] insisted on the immediate subarachnoid injection of antimeningococcic serum in suspected cases of epidemic meningitis even though a clear fluid containing no organisms is obtained on lumbar puncture. Netter has himself reported cases of meningococcus septicemia which did not develop meningitis and recovered from the infection without the use of intraspinous serum therapy. The fact, moreover, that some of the cases of meningitis reported by this observer did not give evidences of meningeal involvement until after a diagnostic lumbar puncture was performed, indicates that the operation may in some instances have been the cause of the localization of the organisms in the central nervous system.

Achard and Laubry,[1] in reporting 3 cases of pneumococcus meningitis, included 1 of a man on whom lumbar puncture yielded 40 c.c. of clear fluid containing neither cells, sediment nor bacteria. Cultures of the fluid, as well as inoculation experiments, proved negative. The following day the patient died and at necropsy an exudate was found covering the entire surface of both hemispheres but especially marked along the vessels. Bacteriological examination of the exudate showed the presence of pneumococcus. The authors conclude that to explain the negative character of the spinal fluid of the day before there must have been a walling-off and lack of communication between the cerebral and spinal subarachnoid spaces, probably by adhesions. This would not satisfactorily explain why they got 40 c.c. of fluid by puncture. They note, moreover, that other meningeal lesions of the cranial cavity may give a clear fluid at lumbar puncture and cite a case of a hemorrhage covering part of a hemisphere in the presence of which lumbar puncture done shortly before death furnished a clear fluid without red cells or leukocytes. With these observations as a basis the authors conclude that whereas a positive fluid gives the diagnosis, a negative one does not exclude meningitis. The inference they make here is that the inflammation in the one case and the hemorrhage in the other were present at the time the fluids were obtained. In the light, however, of what we know concerning the effect of the release of cerebrospinal fluid on the meninges and possibly on the choroid plexus it may well be asked if in both of these cases the lumbar puncture was not partly responsible for the phenomenon noted postmortem.

Voisin[39] studied the spinal fluids of 45 children who were suffering from pneumonia of various types and did not show signs of meningeal irritation. Of these 2 developed meningitis subsequent to the lumbar puncture, 1 in four days and 1 at the end of a month; in

both cases the fluids obtained at the first puncture were normal. In addition to these this observer also investigated the spinal fluids of 38 cases of pneumonia among children who showed clinical signs of meningeal involvement. In 3 of these in which at the first puncture, and even at the second, not a single cell could be found a definite leukocytic reaction was subsequently present. In 2 others in which only a feeble cellular reaction was present at the time of the first puncture there was a marked reaction at the second. Only four fluids were observed which were actually cloudy, the turbidity appearing at the second puncture in two, the first fluids in both having been clear.

The same author with Laignell-Levastine[40] studied the brains of fifteen children, dying of pneumonia, on whom spinal-fluid analyses had been previously made *intra vitam*. Seven of these cases, from which normal spinal fluid had been obtained, showed pathological changes in the central nervous system. The authors observe that in all cases in which there was a leukocytic reaction of the fluid obtained *intra vitam* there was found also an inflammation of the meninges postmortem, but, on the other hand, they were able to find a reaction on the part of the meninges postmortem without leukocytes having been seen in the spinal fluid antemortem. They conclude, therefore, that inflammation of the meninges precedes, in certain cases, the appearance of leukocytic reaction in the fluid obtained by lumber puncture.

Some years later Hutinel and Voisin[17] reported cases in which the spinal fluid obtained *intra vitam* was normal in all respects, but at autopsy meningitis was found. The pathological condition, they add, was absolutely confirmed, and one could suppose that there must have been an obstruction to the foramina of Luschka and Magendie or of the spinal canal itself, either by exudate or anatomical variation, to account for the negative character of the spinal fluids obtained by lumbar puncture antemortem. Dalmenesche,[6] in 1910, noted that the primary fluid of acute meningitis may be clear and free of organisms. Sladen,[35] in the same year, in reporting 23 cases of epidemic cerebrospinal meningitis, calls attention to the frequency with which the complete change in character of the spinal fluid has been noticed to follow lumbar puncture.

Vincent[38] recalled, in 1909, a case which he had observed two years before, in which the primary fluid was clear, contained a normal number of lymphocytes and showed no organisms, either on smear or culture. Three days later a second lumbar puncture yielded a cloudy fluid, containing polymorphonuclear cells and meningococci.

Levy[19] in reporting 165 personally observed cases mentions the case of a boy on whom he performed lumbar puncture for diagnostic purposes. The spinal fluid obtained was clear and cultures of it were sterile. The case rapidly developed a turbid fluid in which

the diplococci were subsequently found; the patient died after sixteen hours.

Sophian[37] recognizes that not infrequently suspected cases of meningitis are punctured at a time when the fluid is not only clear but sterile, and then at subsequent punctures the typical cloudy fluids of acute meningitis containing the characteristic organisms are found. As the majority of cases of meningitis are preceded by a septicemia there is, before frank purulent meningitis has established itself, a period (the accumulative stage), the author thinks, during which the fluid is clear and sterile but increased in amount. As an example of this stage is given the case of a woman from whom 40 c.c. of clear cerebrospinal fluid under high pressure was obtained on lumbar puncture. Examination of this fluid failed to show the presence of bacteria or any increase in cells. Twenty-four hours later a second fluid was turbid and contained many pus cells and bacteria.

Lundie, Thomas and Flemming[21] state that not a case of epidemic cerebrospinal meningitis yet noticed in their command (English Army) has failed to present pus and meningococci in the spinal fluid, and only such cases have been used in estimating mortality. Some of these cases reported by these authors gave clear sterile fluids at first lumbar puncture, containing no pus or formed elements.

Robson and Gould,[30] in 1915, reported 31 cases of cerebrospinal meningitis. With two exceptions the first lumbar puncture invariably yielded turbid fluid in which meningococci could be demonstrated. Of these two the first case was that of a boy who was taken sick with clinical signs of meningitis. A lumbar puncture was done; the fluid was clear, under no increase of pressure and cultures remained sterile. The following day the signs persisted, but lumbar puncture again produced clear fluid. On the third day his condition was about the same and lumbar puncture gave clear fluid for the third time. A blood culture taken on this day was positive, yielding typical meningococci. On the fourth day the spinal fluid was opalescent and permitted the diagnosis of meningitis.

The other case referred to by these authors was one in which a clinical diagnosis of meningitis was made on admission, but the spinal fluid obtained at that time by lumbar puncture was clear and cultures of it remained sterile. The next day a second lumbar puncture yielded a fluid which was turbid and contained meningococci.

Foster[11] in reporting 150 cases of meningitis remarks that for an accurate diagnosis bacteriological tests alone are trustworthy, for, he says, one may frequently obtain two or three perfectly clear fluids before one is withdrawn in which there occurs an abundant growth.

Worcester, Drought and Kennedy[46] mention an interesting case, that of a man, aged twenty-six years, who was admitted to a hospital in collapse and with a temperature of 103°. His appearance

strongly suggested a fulminating case of cerebrospinal fever, but he presented no signs of meningitis. A lumbar puncture revealed perfectly clear spinal fluid, containing no increase in cells, in which no organisms could be found, either in direct smear, centrifugalized sediment or culture. A blood culture taken at this time showed meningococcus (Type II of Gordon.) By evening there was some rigidity of the neck and Kernig sign was positive. A second lumbar puncture gave turbid fluid containing polymorphonuclears and lymphocytes as well as several pairs of Gram-negative diplococci.

Recently, Herrick,[16] as a result of his observation of 265 cases of epidemic meningitis at Camp Jackson, says that the spinal fluid in the stage of meningococcal sepsis, as in other acute febrile diseases, may or may not be under increased pressure, and may or may not show a trace of globulin. The cells are not increased. If organisms are not found in the fluid obtained by the first lumbar puncture they frequently appear in that obtained by the second three or four hours later. That the meningococci first invade the cerebrospinal spaces in the region of the choroid plexus seemed clear to this writer for in some of his cases of meningitis he found it necessary to make repeated lumbar punctures at intervals of two hours before a fluid which contained organisms was obtained. He concluded that the bacteria were brought down by drainage. Furthermore, in two fulminating cases, with speedy death, the spinal fluid obtained by lumbar puncture shortly before death contained no organisms while that secured at necropsy from the lateral ventricles showed numbers of meningococci.

That meningitis does not always follow if lumbar puncture is performed during a septicemia cannot be denied, for the virulence of the organism may be such or its pathogenicity for the meninges may be so modified that its introduction within the subarachnoid space would be harmless. Mention has already been made of a case, seen at Camp Jackson, from which a clear normal spinal fluid was obtained at a time when the blood stream was infected with the pneumococcus and also one in which a blood-contaminated specimen of spinal fluid was culturally positive for meningococcus. Neither of these patients developed meningitis and both went on to complete recovery. Aside from these cases there are several to be found in the literature which in some particulars are similar.

Liebermeister,[20] in 1908, reported a case of meningococcus septicemia without meningitis, in which blood cultures taken seventeen days apart showed the presence of the organisms, whereas two lumbar punctures taken in the interval, one six days after the first and the other the day before the second blood culture, were negative.

A case of Loiseleur and Monziol[23] had been running an intermittent fever for sixteen days, at the end of which time a lumbar puncture gave a negative fluid. Three days later, the symptoms continuing, a blood culture was taken and revealed a meningococcus

infection. Similarly in the case of Sainton and Maille[34] the blood was not cultured until two days after the lumbar puncture was performed. The patient never had any symptoms referable to irritation of the central nervous system, but the explanation was suggested by the presence of a purulent (meningococcic) arthritis.

Bovaird,[4] in 1909, published a case of a young girl who was suspected of having epidemic cerebrospinal meningitis. A lumbar puncture, however, gave 20 c.c. of a clear normal fluid under normal pressure, as a result of which the opinion was changed to that of hemorrhagic purpura. Four days later a blood culture was positive for meningococcus. On the eighth day after admission a second blood culture was sterile, as was also a specimen of blood-stained spinal fluid obtained by lumbar puncture.

Sacquepee[33] reports a case of typhoid fever with meningeal symptoms in which the spinal fluid the day of admission was under slightly increased pressure, contained a moderate increase of lymphocytes, but on culture proved to be sterile. A blood culture at the same time showed both streptococcus and B. typhosus, but there is no note of the case subsequently developing meningitis.

That meningitis does not always follow if a lumbar puncture is performed during certain septicemias should not be permitted to cloud the real issue, for in spite of the exceptions given there is sufficient evidence, it seems, of both an experimental and clinical nature to indicate the need for greater caution in the performance of an operation, which may do harm.

Limitations for the Use of Lumbar Puncture. Recently, there has been a tendency on the part of clinicians to multiply the indications for performing lumbar puncture on patients suspected of having meningitis, until now all that is needed to justify the procedure in the minds of some writers is a history of contact and possibly some clinical evidence of infection. Gillett[12] in discussing the diagnosis of meningism urges that lumbar puncture should be performed at the earliest possible moment and not, as is often the case, only when the condition has become markedly indicative of meningeal irritation, for, he says, it can do no possible harm. Netter,[25] in referring to the symptoms of meningococcus septicemia, states that in every case there should be no hesitation in performing lumbar puncture on the smallest doubt. Robson and Gould[32] in their report of thirty-one cases speak of the procedure as a slight operation which is in no way dangerous and is of great importance in establishing a diagnosis. It is well to recall that in this same series these authors report two cases, quoted above, which developed a true meningitis after such diagnostic punctures. Foster[11] learned from his cases that clinical symptoms could not be relied upon for a diagnosis of meningitis. He advises early puncture, since he feels that bacteriological tests of the spinal fluid alone are trustworthy.

Herrick,[16] after enumerating the manifold symptoms incident to

the septicemic stage of meningococcus infections, asserts that the clinical suspicion aroused by any combination of two or more of them demands lumbar puncture.

The reason for this extreme measure has its explanation in two sources: (1) the belief that the lumbar puncture itself can do no harm, and (2) the demonstration in recent years of the primary septicemic nature of meningococcus infections. Concerning the first of these reasons, enough has already been said to indicate that the withdrawal of the needle does not end the changes initiated by the release of spinal fluid; but to appreciate the second, one must understand clearly the successive stages in the establishment of the proof that epidemic meningitis is a primary blood infection.

In 1899 Gwyn[15] isolated for the first time the meningococcus from the blood stream. Solomon[36] was able to confirm the observation in 1902, and in the following year Warfield and Walker[41] published another case. Opportunities for the further observation of this phenomenon were afforded by the great pandemic of 1905–06, so that in the first of these years Elser[7] was able to report 10 positive meningococcus blood cultures out of 41 observations. In the same year Lenhartz,[18] Morton and Rhode[22] and Weichselbaum and Ghon[45] published isolated cases. All of these, however, were inconclusive in that they did not demonstrate the primary nature of the septicemia, for in all of them except that of Warfield and Walker, in which autopsy was refused and no spinal fluid analysis is recorded, the first lumbar puncture demonstrated that the meninges were already the seat of infection. Thus, many writers continued to accept the teachings of Westenhoeffer,[44] who, while admitting the possibility of a dual pathway of infection for the meninges, namely, by the blood and lymph, felt that the direct extension from the pharynx and the sinuses surrounding the cranial cavity along the nerves and lymphatics was the real explanation. However, cases continued to be reported of meningococcus septicemia complicating meningitis, Goeppert[14] and Robinson.[31] Andrew's case,[2] a fulminating one, from the blood of which the meningococcus was isolated *intra vitam*, showed at autopsy an extravasation of blood in the meninges, but no meningitis. This demonstrated for the first time that the blood invasion could of itself cause death without first affecting the meninges. The report was followed in 1908 by a case of Liebermeister,[20] referred to above, in which two lumbar punctures taken during a meningococcus septicemia proved to be sterile. This patient recovered from the septicemia, thereby definitely proving that a primary meningococcus septicemia could go on to recovery without being associated with meningitis. In 1909 Elser and Huntoon,[8] in their excellent bacteriological studies of the disease advance the opinion that all of the evidence adduced up to that time pointed to the hematogenous origin of meningococcus meningitis. Since then the idea of direct extension of the organisms from the

mouth and sinuses into the cranial cavity has gradually lost support, the present conception of the process of infection being that the organisms gain access to the body probably in the upper respiratory passages; thence they invade the blood stream and produce local lesions by metastasis.[21] The diagnosis of meningococcus septicemia has been gradually facilitated by the clinical observations in recent years of Netter,[25] Bovaird,[4] Gioseffi,[13] Sophian,[37] Lundie, Thomas and Flemming,[21] Worcester, Drought and Kennedy,[46] Foster,[11] Herrick,[16] etc., so that the disease has assumed a place for itself among the acute infections.

At the time that Jochmann and Flexner were testing out their sera (1905–07) it will be seen that the septicemic nature of meningococcus infection had not become very generally accepted, so that serum therapy, though attempted occasionally subcutaneously, became limited practically to the intrathecal route. With the growing conviction, however, that the meningococcus produces a primary systemic infection it gradually became apparent to clinicians that serum should be administered in such a way that it would reach the organisms within the blood stream as well as those in the meninges. Accordingly the intravenous injection of serum has been recommended among others by Chevrel and Bourdiniere,[5] Penna,[29] Sophian[36] and Herrick.[16]

Notwithstanding the evidence that the meningococcus may exhibit all degrees of virulence within the blood stream without involvement of the meninges, from a fulminating infection with death in a few hours to such mild infections that recovery follows in a day or two, the appearance of signs of meningococcus septicemia are still accepted as certain forerunners of meningitis. On the assumption that lumbar puncture can do no harm, spinal explorations are practised on such patients even though they show no clinical signs of infection within the central nervous system. The logical way to handle both types, it seems, would be to treat the blood infection by intravenous therapy and avoid lumbar puncture at least until signs of involvement of the meninges are present. Such a procedure proved effective in several of Penna's cases, for in two instances in which intraspinous treatment was controlled by intravenous he found that the patients did equally well. Monziols and Loiseleur[23] report a case of meningococcus septicemia with focal infection of the pleura. As there were no meningeal symptoms lumbar puncture was not performed and the case cleared up under pleural injection of serum. Herrick also reports the case of a nurse with meningococcus septicemia who got well under intravenous administration of serum alone. A similar case, personally observed on Major Herrick's service, had already been mentioned.

When, during a meningococcus septicemia, definite signs of irritation in the central nervous system have developed there is not much choice left but to make the puncture, for in such cases if the

actual infection is not present and the symptoms have been due to accumulation of fluid or irritation resulting from the toxins of organisms one has in serum therapy a means of repairing any damage that may later show itself.

If a septicemia with any one of the pyogenic organisms other than the meningococcus is present it is questionable whether lumbar puncture should be performed in some instances even though signs of meningitis are present. Such organisms, when present in the subarachnoid space, usually cause a fatal meningitis, and until some methods are found whereby a cure or an amelioration of symptoms can be accomplished the demonstration of a cloudy fluid under the circumstances does little good except to establish the diagnosis. Were our methods of diagnosis more accurate, so that the obtaining of a cloudy infected fluid could be foretold with certainty, the objections to the procedure would not be so strong. This is not the case, however, for so frequently are the symptoms usually associated with meningitis displayed during acute infections that lumbar puncture, even in what are apparently unmistakable cases of meningitis, becomes in reality an exploratory operation. The frequency with which clear fluids are obtained in such cases is evidenced by the copious literature on the subject. The "Meningismus" of Dupre, the "serous meningitis" of Quincke,[30] the "meningotyphus" of Sacquepee,[33] the "sympathetic meningitis" of Netter and numerous other designations used to cover these clinical paradoxes are but expressions indicating the frequency with which symptoms of central nervous system irritation are found without bacterial invasion of the meninges.

The phenomenon of producing meningitis by the withdrawal of spinal fluid during septicemias is felt to be due in part to physical factors involving the disturbance of pressure relations within the cerebrospinal cavity. If this is true it would seem that the chance of producing such an infection would be directly proportional to the amount of spinal fluid removed. In the animal experimentation, however, it was found that puncture of the occipito-atlantoid ligament without withdrawal of fluid had the same effect as actual withdrawal. The explanation for this proved to be that after such a procedure a definite leakage of fluid takes place into the soft tissues of the neck through the opening made in the dura. Before this was determined it was hoped it would be possible to reduce the incidence of subsequent meningitis in man by limiting the removal of fluids to minimal quantities sufficient only for diagnostic purposes. But the same factors of leakage of spinal fluid into the surrounding tissue through the hole made by the needle in the spinal membranes are present in man as well. The use of needles having small diameters would doubtless aid in reducing such leakage and is consequently to be recommended.

SUMMARY. It had been found, clinically, that infections of the meninges occur not infrequently following the release of normal spinal fluid by lumbar puncture during a septicemia. Five such observations have been made personally and similar cases have been found in the literature. The close analogy existing between these cases and certain experimental observations reported elsewhere indicate that the withdrawal of spinal fluid should be seriously considered as a causative factor in the production of meningitis under certain conditions. To prevent the possible accidental production of a meningitis as a result of diagnostic lumbar puncture it is recommended (1) that careful consideration be given the bacteriological study of the blood before such punctures are attempted; (2) that in acute diseases, in the absence of definite signs of irritation of the central nervous system, lumbar puncture should be avoided unless it is first conclusively shown that the blood stream is free of infection; (3) that when the clinical symptoms are such as to render a lumbar puncture advisable, minimal quantities of fluid should be withdrawn, sufficient only to permit necessary laboratory tests to be made; (4) that small-bore needles should be utilized in performing the operation to prevent as much as possible subsequent leakage of spinal fluid into the surrounding tissues.

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RELATIONSHIP OF THE STREPTOCOCCUS HEMOLYTICUS TO "INFLUENZA" AND PNEUMONIA.[1]

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In reviewing the laboratory work of all cases of "influenza" and pneumonia, many of which were admitted with the diagnosis of influenza, as diagnosed at our hospital from September 1, 1918, to October 20, 1918, our attention was called to the very common association of Streptococcus hemolyticus with these conditions, and an attempt was made to summarize the laboratory work on all such cases from September 1, 1918, to January 1, 1919. We also referred to previous reports to the Surgeon-General's Office dated July 20, 1918, and October 19, 1918.

No attempt was made to try to differentiate hemolytic streptococci on other sugars than glucose and lactose and in the results we referred to the organisms only as their hemolytic action on blood was concerned.

A bacteriological summary of 554 sputa examined showed a great predominance of Streptococcus hemolyticus over other organisms.

[1] Read before the Weekly Staff Meeting at U. S. A. General Hospital No. 2, Fort McHenry, Maryland, February 5, 1919.

Bacteriology of Sputum (All Typed for Pneumococcus) and Throat and Nose Cultures from September 1, 1918, to January 1, 1918.

		Per cent.	Per cent.
Pneumococcus type I		4 (12)	0.72
Pneumococcus type II		3 (9)	0.54
Pneumococcus type III		5 (14)	0.92
Pneumococcus type IV		22 (65)	3.975
Total pneumococcus		34 (100)	6.155
Bacillus influenza		7	1.265
Micrococcus catarrhalis		2	0.36
Staphylococcus aureus		5	0.92
Streptococcus hemolyticus		506	91.30
Total		554	100.00

In considering the above results it must be borne in mind that a great percentage of apparently normally healthy individuals carry Streptococcus hemolyticus in throat cultures, but rarely as high a percentage as the above. A brief summary of our carrier report of July 20, 1918, follows:

Carriers of Streptococcus Hemolyticus Reported to the Surgeon-General's Office July 20, 1918. In a series of 100 apparently normal individuals, surgical and other patients on our wards not suffering from influenza or pneumonia, the cases having been taken at random and not selected, 55 per cent. showed Streptococcus hemolyticus positive in throat cultures and 45 per cent. negative. This was during the months of May, June and July, when we had very little of our respiratory diseases. Among the Streptococcus hemolyticus empyemas and pneumonias when put out in the open air and sunlight there was a marked drop in the number of positive cultures in the throat and affected secretions. When removed from this into the wards there was a marked increase again in Streptococcus hemolyticus carriers.

A Summary of Antemortem Blood Cultures:

		Per cent.
Pneumococcus type IV	1	1.62
Streptococcus viridans	1	1.62
Sterile	60	96.76
Total	62	100.00

A Summary of Postmortem Heart and Lung Cultures in First Fourteen Taken:

		Per cent.
Pneumococcus type IV	1	7.0
Streptococcus homolyticus	13	93.0
Total	14	100.0

A Summary of Combined Antemortem and Postmortem Cultures:

		Per cent.
Pneumococcus type IV	2	2.6
Streptococcus hemolyticus	13	17.2
Streptococcus viridans	1	1.3
Sterile	60	78.9
Total	76	100.00

(Of all organisms found the Streptococcus hemolyticus, 81 per cent.).

A Summary of Pleural Cultures Antemortem:

		Per cent.
Pneumococcus type IV	2	8.4
Streptococcus hemolyticus	8	33.3
Sterile	14	58.3
Total	24	100.00

A Summary of Pleural Cultures Postmortem:

		Per cent.
Pneumococcus type IV	1	1.8
Streptococcus hemolyticus	53	98.2
Total	54	100.00

A Summary of Pleural Cultures Antemortem and Postmortem:

		Per cent.
Pneumococcus type IV	3	4.3
Sterile	14	20.0
Streptococcus hemolyticus	53	75.7
Total	70	100.00

The Media Used for Cultivation. The media most commonly used were 0.5 to 1 per cent. glucose or dextrose blood-agar and bouillon. At first when such overwhelming percentages of Streptococcus hemolyticus in pure cultures were found it was thought best to try other media to bring out other types of organisms—Loeffler's blood serum, sheep serum, dextrose agar, Russell's double and triple sugar media, hemoglobinized inspissated dextrose sheep serum, etc., were tried in numerous cases, with the same findings of a large percentage of Streptococcus hemolyticus. The best medium for the growth of the hemolytic streptococcus in our experience was 1 per cent. blood-dextrose bouillon, the blood in nearly all cases used in 5 to 10 per cent. proportions having been human blood citrated. In this medium growth was very profuse, hemolysis rapid, acid production marked and in the medium near the surface acid hematin was rapidly formed. If kept five to ten days sterile subcultures were often obtained, due to the organisms killing themselves. The streptococci occurred typically in diplostreptococcus form of varying lengths, in chains containing from four to six or more, the longer chains having more "coffee-beaned" forms. They stained readily with most of the anilin dyes, and were Gram-positive. They were

facultative anaërobes growing profusely in partial anaërobiasis, but free access of oxygen, however, furnished the most suitable environment for growth. In the blood-dextrose broth the colonies grew characteristically spreading up along the sides of the test-tube on the blood-dextrose agar appearing as tiny, pin-pointed, moist and almost transparent droplets surrounded by a clear and well-defined zone of hemolysis. With discrete colonies this zone was circular and varied in diameter from one-eighth to one-half inch.

The mouse method as devised by Avery and the artificial culture method were employed in the usual manner for our typing.

Urine Examination of Pneumonia and Influenza Cases. Up to October 20, 1918, 500 specimens were examined, of which over 25 per cent. showed albuminuria. None showed glycosuria. From September 1, 1918, to January 1, 1919, the total number of urines examined was 1082. A summary of the findings follows:

		Per cent.
Albumin	121	11.18
Albumin and casts	198	18.30
Total albumin	319	29.48
Normal urines	763	70.52
Total	1082	

A large number of urines showed blood microscopically and some grossly. The toxicity of the urine up to 5 c.c. for animals when it had been filtered through a porcelain (diatomaceous) filter was nil. No precipitins or agglutinins were found in the urine against the Streptococcus hemolyticus. Unfortunately we could not carry out other chemical or metabolic studies on these urines during the emergency.

White Blood Counts made on Pneumonia and Influenza Patients. The total number of white-blood counts made was 444. The counts were higher in uncomplicated cases in which the patient recovered. In fatal or complicated cases the counts were lower. The average count throughout the whole series was 11,800. The differential counts varied between normal or, in the pneumonia cases especially, slight polymorphonuclear increase. Up to October 20, 1918, the average white-blood count was between 4000 and 6000, a noticeable leukopenia at times. From October 20, 1918, to January 1, 1919, the average white-blood count was between 15,000 and 20,000.

Attempts were made to determine where, in the body, the greatest fight was taking place and what tissues and fluids in the body were entering into the struggle for immunity and how.

The Opsonic Index on Streptococcus Hemolyticus Pneumonia Cases. The white count of very few patients showed any aggression at all to Streptococcus hemolyticus. In the experiments we found that in pneumonia and influenza, cases infected with Streptococcus hemolyticus showed very little aggression even toward such organisms as staphylococci.

The opsonic index during the course of the disease, both previous to and after the crisis, was slightly lower than normal. This tended to show how little in general the white cells fought in these cases.

Toxic filtrates of Streptococcus hemolyticus cultures for mice, rabbits and less for guinea-pigs were obtained, but were not comparable in potency to similar filtrates of diphtheria and tetanus cultures. The destruction of the red-blood corpuscle was due to a specific hemolysin produced by the organism in its growth. Marked hemolysis occurred early before a culture of hemolytic streptococcus developed any marked or definite acidity, showing that acidity was not the cause of the hemolysis here, although it may later have entered into the reaction. In dextrose broth cultures the filtrate, which was quite acid, was neutralized accurately and a red cell suspension added to it, with hemolysis resulting. Some investigators believe there is a direct relationship between virulence and hemolytic action, others that the hemolytic power is a constant and fixed characteristic of certain strains. Observation here indicated that the property of hemolysis is a fixed and racial characteristic of certain streptococci and that the virulence of these strains may be enhanced by animal passage and reduced by cultivation on artificial media.

In one of our cases in which the pleural fluid was teeming with hemolytic streptococcus we had some citrated normal blood for hemolytic tests and added some pleural fluid to the whole blood to see if the organisms would grow in it. After forty-eight hours, incubation no subcultures of Streptococcus hemolyticus could be obtained. In looking into the matter we found that 10 per cent. sodium citrate was used by mistake and determined to learn whether sodium citrate was antiseptic for the Streptococcus hemolyticus and in what strength. Streptococcus hemolyticus was incubated with sodium citrate from 80 per cent. strength down to 0.5 per cent. for twenty-four hours, then subcultured in blood-dextrose broth. No subcultures were positive down to 2.5 per cent. All from there down were positive. This factor might be of some value in the use of sodium citrate for blood cultures, transfusions and possibly by mouth or other methods in the treatment of Streptococcus hemolyticus infections, general or local.

Normal human blood serum showed no agglutinins or precipitins against Streptococcus hemolyticus in dilutions up to 1 : 1000. Guinea-pigs were immunized by gradually increasing doses of Streptococcus hemolyticus vaccine from 250,000,000 upward and showed agglutinins against Streptococcus hemolyticus up to 1 : 32 and showed precipitins up to 1 : 8. Attempts were made to determine whether or not the Streptococcus hemolyticus pneumonia cases, some time in the disease, showed any antitoxic properties against this organism and some explanation of our sterile blood cultures in antemortem cases where localized infections (lungs, pleura, etc.), with general symptoms, were so evident. As

controls, a non-infected individual's blood was collected in citrate, used pure, diluted 1 : 2, 1 : 3 and up to 1 : 100 with dextrose broth. The amounts of blood or mixture in each tube were 1 c.c. Each of these tubes was contaminated with Streptococcus hemolyticus and incubated twenty-four hours, then subcultures were made. A normal individual's blood had no antitoxic properties in any dilution. All blood of patients tested having Streptococcus hemolyticus pneumonia, either before or after the crisis, showed at least inhibitive effect on the original contaminations in pure blood and in 1 to 2 dilution, not higher than this, in some cases not even subcultures were obtained in pure blood and 1 to 2 dilution showing some antitoxic or bactericidal effects of the blood of these patients. Some investigators have been getting positive Streptococcus hemolyticus blood cultures in a high percentage of their pneumonia cases, but only in the first ten to twenty-four hours or very late in the disease. The experience in the above experiments might possibly aid us in our explanation of negative blood cultures in these cases brought to this post comparatively late in the disease for a positive culture.

In testing for agglutinins and precipitins in pleural fluids agglutinins up to 1 to 320, precipitins, 1 to 10 were found. Several pleural fluids immediately after chest puncture showed a decided acidity as high as 1 degree to phenolphthalein, and readily turned blue litmus red. When inoculated into white mice and guinea-pigs the mice showed an immediate marked toxicity, which after four to six hours gradually subsided, while the guinea-pigs were only temporarily sick from this effect up to 5 c.c. of filtered pleural fluid having been administered. When roentgen rays and pleural punctures were frequently made there was noticed an early pleuritic effusion following the pneumonia, with a rapid spread in the amount of fluid (even when all other tissues at autopsy were very dry). At first this fluid was clear straw-colored. Cultures of it were sterile, then in twenty-four to forty-eight hours became definitely purulent, showing Streptococcus hemolyticus. When filtered blood serum was inoculated into white mice and guinea-pigs practically no toxic effects were noted in the guinea-pigs and only very slight effect on the mice as compared to the toxicity of pleural fluid. Virulent cultures from fatal cases of Streptococcus hemolyticus infections were used in our experiments. Heated at 55° C. for one hour, 500,000,000 organisms were given by a small needle into guinea-pigs intracardially, giving rise to slight temporary reactions for several hours. When these organisms were given with 10 per cent. sodium citrate no reactions of this type occurred in the few animals inoculated. Guinea-pigs were next inoculated with live Streptococcus hemolyticus cultures 0.5 c.c. intracardially. They all showed toxic reaction for some hours, which subsided, although mice inoculated intraperitoneally with same cultures died universally. The following methods were adopted subsequent to this in order to see what effect

exposure and lowered resistance had on our inoculation experiments. After inoculating 0.5 c.c. of virulent Streptococcus hemolyticus cultures intracardially into guinea-pigs they were put into our incubator, where water was kept steaming to moisten the air, for twenty to thirty minutes. The animals during this time showed marked polypnea and dyspnea, then were permitted to run about in the open cold air. Lobar and lobular pneumonia of the typical streptococcus type were produced, as manifested by inspection signs of pneumonia, confirmed by roentgen rays and autopsy. Two animals were permitted to recover so that roentgen-ray plates in the various stages of pneumonis could be obtained, one lobar and the other lobular. When these same organism cultures were incubated in 10 per cent. sodium citrate for twenty-four hours, then inoculated intracardially, the "devitalized" growth gave no reaction. Two guinea-pigs that were immunized against Streptococcus hemolyticus by giving vaccine when given the virulent cultures intracardially with "lowered resistance treatment" developed typical Streptococcus hemolyticus purulent pericarditis, one animal having as much as 8 c.c. of pus in its pericardium. When two of our guinea-pigs that had not been given lowered resistance treatment with their inoculations and showed only temporary reactions were subsequently given the same inoculation with lowered resistance treatment they developed pneumonia, as confirmed grossly at autopsy.

Streptococcus hemolyticus cultures sprayed on the pharynx of normal guinea-pigs, which was done on only a limited number of animals, showed no susceptibility of normal mucous membrane to the infection. In our sections of lungs from fatal cases, showing numerous streptococci all through the involved areas by Gram-staining, the tissue cells, and especially the alveolar epithelium, attacked or were attacked by the organisms. Many of the epithelial cells were engorged with streptococci either in good condition or in degenerated stages.

Pathological findings of 104 autopsies were summarized, showing a lobar or lobular pneumonia, or both, in one or more lobes and associated changes in various organs and tissues of the body.

Most of our cases were very good specimens of manhood. From their histories they were hearty meat eaters, although I do not know that this had any bearing upon the infection. In many cases petechiæ and fabrilulæ were found in the skin, and under serous and mucous membranes, petechial hemorrhages. Jaundice was noted in 24 per cent. of our cases, with no evidence of direct mechanical obstruction in ducts of the gall-bladder—evidently "hematogenous" jaundice. The general glandular and osseous systems showed nothing striking anywhere. There were slight parenchymatous changes in the muscular system. The various tissues, except where there was local Streptococcus hemolyticus infection, were extremely dry in very many of our early cases, although in the pleural cavities as much as 1500 c.c. of fluid were present. Parenchymatous changes

were noted to a greater or less degree in the majority of the organs examined—depending to a large extent upon the degree, severity and duration of the infection, etc.

Summary of pathological findings on 104 autopsies.

			Per cent.
Lobar pneumonia.			
1 lobe	Right . . . 3 cases (50 per cent.) / Left . . . 3 cases (50 per cent.)	6 cases	7.4
2 lobes		14 cases	17.3
More than two lobes		61 cases	75.3
		81	

Red hepatization about 70 to 80 per cent.
Gray hepatization about 20 to 30 per cent.
Gross gangrene or abscess of lung 9 cases, or 9 per cent.

Lobular or bronchopneumonia:	
Right side	16
Left side	11
Both sides	13
Total	40

Lobar and lobular pneumonia occurred combined in 36 of these 40 cases. It would seem from these results that the etiological nomenclature would be preferable to the geographical since Streptococcus hemolyticus can be demonstrated in tissues, sections and cultures in a large percentage of these cases, and a good name for them would be Streptococcus pneumonias instead of lobar or lobular.

			Per cent.
Pleurisy:			
Purulent	Left	14	26.4
	Right	31	58.5
	Both sides	8	15.1
	Streptococcus hemolyticus	53	75.7
	Type IV	3	4.3
	Sterile	14	20.0
	Total fluids	70	
Adhesive	Right	5	
	Left	2	
	Both sides	3	
	Total	10	
Fibrinous	Right	2	
	Left	5	
	Both sides	2	
	Total	9	
Pericarditis	Acute plastic or early fibrinous	9	
	Adhesive	3	
	Purulent	7	
	Total	19	

18.2 per cent. of all infections.
Chronic vegetative endocarditis in 4 cases.
Subcutaneous emphysema, 2 cases.
One had a lung puncture.
One perforative purulent peribronchitis (left).

Many of our pneumonia cases, both lobar and lobular looked like very large or very small pulmonary infarctions, hemorrhagic in type, the centers of which in the lobar pneumonias (in gray hepatization) were gangrenous or necrotic. On closer examination they had many of the smaller vessels occluded by thrombosis while the bronchi, except in some cases accompanying the vessels, did not seem completely occluded by plugs or masses of fibrinous or other material. All these things would tend to make one think that the infection, after a temporary bacteremia (from previous statements), entered the pulmonary circulation, was distributed and localized like hemorrhagic infarctions, in this way causing pneumonia. Further experimentation and investigation are necessary to clear up this matter, very important from many points of view, carriers, prophylaxis, pathology, etc., of these cases.

Further questions that came up in our cases were: "Did the lobar pneumonia begin as lobular or bronchopneumonia and later become lobar or were each of these types separate and localized in its division throughout the entire course of the disease and distinctive as such?" Finding both lungs entirely consolidated from apex to base, in forty-eight to seventy-two hours from the onset of the disease, and from other observations, were inclined to the latter statement.

Description of Lungs. Many of our lobar pneumonias showed in red hepatization stage a reddish-brown or very congested venous appearance, with numerous subpleural hemorrhages of variable sizes, scattered over large or small areas. The lungs were extremely dense and frequently in a very marked inspiratory state, in typical cases, having no crepitation anywhere, and sinking rapidly into water. On section the characteristic pneumococcus red hepatization was not present. The lungs were very congested and succulent, blood oozing out everywhere, giving a moist, smooth appearance, with no plugs of fibrin in the bronchioles, but often a liquid purulent material. Microscopically the alveoli and interstitial tissues were filled with erythrocytes in predominance everywhere, a few leukocytes and alveolar epithelia, with a relatively smaller proportion of fibrin than in pneumococcus pneumonias, suggesting the name "hemorrhagis pneumonitis." Many of the smaller vessels were thrombosed or engorged in addition to capillary engorgement. In a few cases a definite acute peribronchiolar inflammation was seen, a definite leukocytic layer around the bronchiole of varying width being seen microscopically.

In the gray hepatization stage the lungs looked reddish gray, grayish or yellowish gray; the affected tissues were less tense than in the red stage and somewhat softer, very friable; the cut surface was smooth and moist, showing an exudate of partly emulsified inflammatory tissues. Microscopically, many red cells were still found, with many alveolar epithelial cells; the predominating cells were leukocytes, very little fibrin, as in the red stage, having been present.

In older grayish lungs the cellular contents of the alveoli were granular and fatty showing marked degeneration and dissolution. Streptococci were found profusely in these sections also in blood-vessels in all stages, some of the alveolar epithelial cells having been engorged with them.

The involvement in some cases appeared like huge pulmonary infarctions, occupying a large portion of a lobe, grayish in the central part, reddish or congested about this portion, the very center abscess-like and extending wedge-shaped toward the hilum of the lung. Small and large abscesses were not very infrequent; smaller ones in the lobular as well as the lobar involvements.

The lobular pneumonia cases in some were similar to the usual types of bronchopneumonia, and in others were like pulmonary infarctions, except for the fact that they did not show the usual pictures of later pulmonary infarctions when the pneumonias were prolonged, tending more to become purulent or to go on to complete resolution. Others showed peribronchiolitis or purulent bronchitis. In nearly all cases the lungs were very congested. Often there were conglomerate or diffuse lobular pneumonias appearing almost like lobar pneumonias, but were not completely solidified as in the latter. Microscopically isolated fields would show almost the same pictures as seen in various stages of lobar pneumonia, except for a larger amount of alveolar epithelium, less fibrin and usually a great leukocyte content, with a fair amount of mucus and a few red cells.

The pleura was involved, as seen in our previous data, in a very large percentage of our cases, varying in the type and degree of involvement and depending on whether it was dry, plastic or simply roughened and hyperemic; whether there was a fibrinous deposit, with or without fluid; whether this fluid was definitely purulent and thick or thin and flaky, with many streptococci in it. The adhesive pleuritis was slight or marked in thickness and extent. In one of our cases there was a pulmonary abscess in the center of gray hepatization, which was surrounded by a localized purulent pleuritis, and the abscess had a communication with the bronchus. In another we had a pyopneumothorax, communication having been free between the pleura and bronchus. The layers of the abscesses consisted of centrally necrotic disintegrating lung tissue, surrounded by a layer of solidified lung, containing leukocytes and some young connective-tissue cells, around which in turn was a layer of edematous lung.

The heart, in addition to pericarditis in quite a few cases, showed frequently subpericardial hemorrhages of varying sizes, and almost universally a condition of extreme diastole of the right side, with some coronary and venous congestion.

In concluding, we call attention to the fact that the data written was meant chiefly as a summary of laboratory work as related to so-called influenza and pneumonia at this post, and no attempt has been made to review the entire epidemic or to give an exhaustive review of the subject.

THE INFLUENZA-PNEUMONIA EPIDEMIC AT CAMP DODGE, IOWA, 1918.

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AND

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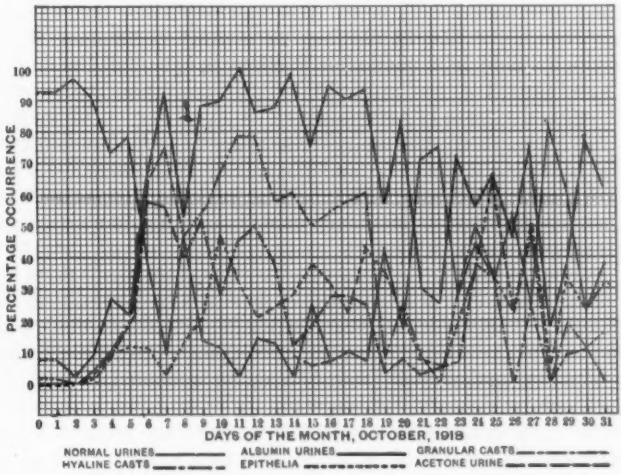
So much has already been written and spoken on the manifestations of the recent pandemic, and there has been such marked agreement on the general features as shown by reports from the various cantonments and civil centers, that more than a cursory comment on those features would be superfluous. The coming and the going were startling in their suddenness; the numbers attacked were overwhelming; the ravages of the disease shown by the blue faces and labored breathing, and the deaths so sudden and numerous, that many exclaimed, "This is the plague!" The revelations of the tissue damage at the autopsy table were convincing that once the disease invaded the body to any depth, drugs could have but little effect.

Knowing the epidemic was ravaging other cantonments and civil communities, the medical officers of Camp Dodge were on the lookout for cases of the disease, isolating by cubicle all persons with respiratory infections and culturing particularly for the Bacillus influenzæ. This did not appear to be of great value, as throat cultures of many patients previous to that time had shown that organism. The convincing proof that we were invaded came from the rapid increase of admissions. The hospital population had been running unusually low, around 1200, with a total daily admission rate of 40 to 50. The first reported influenzas were on September 22, 1918. The admissions ran up rapidly, 240, 411, etc., three days showing over 1000, the maximum being attained October 4, 1918 (1275), and fell as rapidly, so that on October 19 there were but 28. The maximum number of all classes of disease (all other classes being cut to minimum, possibly 300 to 400) occupying beds on one day was 8000 on October 8. The total deaths to November 1 was 702. The highest death-rate (82) occurred on October 12.

The beddage of the hospital normally, according to the number designated per ward, which varied from time to time, was 2000 to

2200. By the use of corridors and porches this was expanded to nearly 3000 and the taking over of 60 barracks, "Y" and "K. C." buildings and officer's quarters, enabled us to care for the balance of the patients, some sixty extra medical officers and between 300 and 400 volunteer nurses. The emptying, cleaning and equipping of these buildings, the care of the immense number of sick, the establishing and maintaining of numerous messes and a substation medical supply depot was an immense physical task, the performance of which reflects great credit on the commanding officer and on those in authority over us and on the Quartermaster's Department, Red Cross and other volunteer agencies.



The unfaltering devotion of those of all ranks in attendance on the sick and the uncomplaining conduct of those afflicted were inspiring.

The plan of subdividing responsibility was followed by appointing supervisors of sectors of wards and barracks. Those who came to us gave invaluable aid, among them, Colonel Jennings, of Brooklyn, Majors Dare and Codman, of Philadelphia, who were mobilizing units in the camp. Daily meetings of a "pneumonia board" were held to discuss the situation and frequent talks given the medical officers as well as issuing of bulletins to instruct medical officers.

Some 25 medical officers were stricken but none died. Over 150 nurses broke down and 8 died. About 20 of the Base Hospital enlisted personnel died. It was noted that practically none of either of these classes who went through the epidemic last spring, whether ill then or not, were sickened. Not a man in the receiving ward, all old men, though breathing the air of rooms through which the

thousands passed, was taken ill. On the other hand, a regiment coming from Alaska furnished the largest mortality. These facts would suggest an acquired immunity by contact and gives hope that methods of establishing an artificial immunity may be found.

The registrar's figures show that from September 16 to December 15 inclusive 10,041 cases of influenza were admitted and diagnosed. The camp epidemiologist reported 1000 cases treated in infirmaries; 2081 cases of pneumonia followed, of which 747 died, making a mortality of 35.8 per cent. of pneumonias, or considering the total number of cases of influenza in camp as 11,000, the mortality of the epidemic 6.8 per cent. It is believed that many cases of pneumonia went undiagnosed during the rush. In 300 charts of cases discharged as influenza only, a study revealed evidence given by the charts themselves that 24 of them were really pneumonia; if this proportion would hold out in the 9000 cases this would mean 720 cases and bring the total up to 2800, with a corresponding lowering of the mortality rate of pneumonia to 26.6 per cent. The average monthly strength of the camp for October, the period of intensity of the epidemic was 32,956 and the deaths 700, causing a camp mortality of 2.12 per cent. The white and colored troops numbered practically 29,000 and 4000 respectively and the morbidity and mortality were almost identic.

Incidence of fluid in the chest: In the 122 autopsies, 70 cases had pus in the chest, 24 more had infected serum and practically all had some fluid. This proportion if carried out in fatal cases not autopsied added to the diagnosed and operated cases plus a probable considerable number undiagnosed, but apparently recovered, would give a very high incidence of fluid in chest. The diagnosis is unusually difficult. The pathologist's report of finding large areas of edema around smaller patches of infected lung would explain some of the changes in physical findings from day to day, the findings due to edema changing rapidly.

The presence of rales in so many influenza cases and the low blood count in both influenza and many uncomplicated pneumonia cases raises the question whether influenza and pneumonia are not both due to the influenza bacillus or to some unknown organism, and whether the secondary invaders, in this camp chiefly the Streptococcus hemolyticus, are responsible for pus formation only.

Together with other laboratory work on account of stress, urinalysis had to suffer, but the accompanying chart shows the marked increase in cases showing albumin and casts during the height of the epidemic, agreeing with the constant postmortem findings of nephritis.

The investigations of Lieut. Seham, camp epidemiologist, seem to show that several individuals and organizations may have carried the disease into camp: in particular members of an ambulance company, who had driven ambulances to Chicago, remained there

a day or so, where the disease was active, and then returned, some were taken ill on the train and others later, these being among the first admitted to the hospital.

TREATMENT. Each supervisor was authorized to direct the treatment in his sector. As a rule the medical treatment of the simple influenza cases consisted of elimination, rest, use of aspirin or salicylates and alkalies; gargles were used and many throats painted with nitrate of silver solution. The routine treatment in this hospital for pneumonia had been the use of digitalis and opiates as required and more active stimulation if indicated.

Four different substances were administered by the intravenous method.

1. Glucose: A 2.5 per cent. solution of Merck's purified glucose in distilled water was made; this was filtered and 200 c.c. placed in each of the desired number of Erlenmeyer flasks; autoclaved for fifteen minutes at 15 pounds' pressure; cooled to 40° C., when 10 c.c. of a 30 per cent. aqueous solution of sodium bicarbonate was added; above 40° C. the soda is disassociated. Dose, 180 to 250 c.c.

1140 injections were given to 475 men, of whom 97, or 20 per cent., died. So many desperate cases showed marked improvement that many ward surgeons, though not all, approved the treatment. Most cases showed a sharp reaction with a chill, and this seemed to be a favorable sign.

2. Formaldehyde solution: 7 minims of formalin were added to 100 c.c., quantities of physiological salt solution and sterilized in Erlenmeyer flasks. Dose, 80 to 100 c.c.

595 injections were given to 243 men, 22 per cent. died.

3. Peptone solution: A 10 per cent. solution of commercial peptone in distilled water was prepared; autoclaved and filtered three or four times to give clearness; put in Erlenmeyer flasks, placed in Arnold sterilizer for twenty minutes. Dose, 8 to 10 c.c.

590 injections were given to 243 men, of whom 20 per cent. died.

Of these three methods the last commends itself by reason of its simplicity. It did not give as marked a reaction as the other two, but showed a rise of temperature. Naturally the query arises in view of the fact that, statistically, the cases treated by all three of these different substances, all given intravenously, and to a great majority of cases of the grave type, showed a mortality less than the average of the epidemic, and that a reaction occurred, in some cases, alarming for a short time whether the beneficial action was obtained by arousing the protective forces of the body; a very limited number of cases studied by blood counts before and after the injections, seemed to show that a leukocytosis was produced.

4. Convalescent Serum: Convalescent patients were bled, the clot allowed to form, the serum pipetted off, a Wassermann test made, cultures taken, the serum inactivated at 56° C. and the recipient's compatibility tested. Dose, 30 to 70 c.c.

This method was used at first on desperate cases only and, judging by them, the results were not encouraging. In a series of 14 cases in which the serum was given as soon as practicable after the diagnosis of influenza-pneumonia was made but one died and the courses of the others were short.

The fact that many apparently desperate cases under symptomatic or digitalis therapy had crises or sudden changes for the better made it difficult to properly value the intravenous methods.

Vaccines: The army influenza vaccine had not reached us at the time of the epidemic. Sherman's No. 38 mixed vaccine was used in the treatment of a limited number of cases and was believed by Major Arthur Dare, who directed its use, to be of benefit. A similar mixed commercial vaccine was used on several hundred influenza cases in the hope of preventing the pneumonia sequel, but the burden of work prevented careful statistical study, and the consensus of opinion was that no demonstrable benefit resulted.

It is agreed by all that absolute rest in bed, fresh air, plentiful use of water and nourishing, simple diet are the essentials of treatment. Those on porches did better than those in wards; patients who had been on porches and moved in asked to be taken out again. Great caution should be used in letting patients up or undertaking work, as myocardial weakness often results. It was deemed wise to hold the patients in the hospital until the blood count fell to 10,000, as higher counts had indicated pus in some cases, which it was not possible to diagnose until a considerable time had elapsed.

Our judgment, based on our experience, is that the problem for the future is the discovery of some agent, along serum or vaccine lines, for the treatment and more particularly the prevention of the infection. Preceding this the offending organism must be identified definitely, as we believe now is not the case.

LABORATORY REPORT ON EPIDEMIC PNEUMONIA,

CAMP DODGE, IOWA.

By William G. Dwinell, Major, M.C., U.S.A.,

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During the week preceding the sudden appearance of the epidemic of September 28, 1918, three distinct outbreaks of an infectious nature occurred in widely separated sections of the Base Hospital at Camp Dodge. Pharyngeal cultures from these cases showed Streptococcus hemolyticus and Bacillus influenzæ present in unusually large numbers. Admissions during this period increased moderately in number and an unmistakable but not alarming number of acute nasorespiratory disturbances, not unlike similar clinical conditions of the preceding month, gave warning of impending trouble.

UNCOMPLICATED INFLUENZA.

September 29, 1918, laboratory workers detailed to the admitting office, cultured and made white blood counts on 152 cases. It was found that the Bacillus influenzæ was present in 66 per cent., Streptococcus hemolyticus in 45 per cent. and the M. catarrhalis in 71 per cent. of the cultures and that the average count was 9300.

Clinical notes on the 152 cases taken on admission to the hospital showed the following:

Onset	Gradual, 72	Headache	101
	Sudden, 38	Cough	61
Tonsil irritation	Severe, 27	Epistaxis	14
	Moderate, 45	Pharyngitis	40
Chest rales	67	Conjunctivitis	56
Photophobia	55	Apathy	13

Further observation of these cases established the average duration of temperature at four days; the average stay in the hospital at nine and one-tenth days and the 890 white blood counts ranged as follows per day:

First day	9300	Fifth day	7200
Second day	8000	Sixth day	7700
Third day	8200	Seventh day	8200
Fourth day	6000	Eighth day	8200

REPORT ON 53 INFLUENZA PNEUMONIA AUTOPSIES.

Between October 3 and October 11, 53 complete autopsies were performed. The following data has been compiled from the records on the first 53 cases of epidemic pneumonia autopsied by Captain Arthur S. Brumbaugh, M.C.

A purplish mottling of face, neck and dependent portions was present in nearly all cases dying within two weeks of onset. The gross pathological lung lesions divide the findings into three classes or types of pneumonia: (1) The broncho-interstitial type, which showed small interstitial hemorrhagic areas about moderately thickened bronchi of varying size, standing out prominently from the sectioned surface and exuding dark red blood. (2) the lobular type, in which hemorrhagic areas of infiltration of varying sizes, without noticeable bronchial thickening, were encountered. Both types were not unlike the conditions found and described by Dr. MacCallum during the pneumonia epidemic of May, 1918. Several cases were found having in one lobe lesions characteristic of the broncho-interstitial type, while the adjoining lobe revealed a picture of the lobular form. To this unusual condition the term mixed or broncholobular pneumonia was given. This nomenclature, while describing accurately many of the lung lesions grossly, should not be relied upon too implicitly, as further histological study may place a much larger number of cases in the mixed or broncholobular class.

The following table shows the number and percentages of the

various types of pneumonia and empyema found at autopsy of 53 cases:

		Per cent.
Pneumonias:		
Broncho-interstitial	23	43
Lobular	18	34
Mixed	10	19
Lobar	2	4
	53	100
Empyemas:		
Bilateral	7	31
Right	5	26
Left	10	43
	22	100
Infected serosanguineous pleuritis:		
Lobular	12	63
Broncho-interstitial	4	21
Mixed	3	16
	19	100

Of the 31 cases dying without empyema, 29 died within two weeks of onset of the first symptoms, the average duration being seven days; the extremes were three to thirteen days. The 2 dying later than fourteen days died at fifteen and forty-four days respectively from the date of onset.

Because of the uncertainty attending the onset of the pneumonia the duration of the disease in all cases was figured from date of onset of first symptoms of illness.

COMPLICATIONS OF 53 CASES.

Process.	Number.	Average duration, days.	Complicated by empyema.
Parenchymatous degeneration of kidneys	53		
Splenic tumor	29		
Acute adrenalitis	28		
Mediastinitis	19	13.5	14
Pericarditis	9	11.8	4
Peritonitis	6	22.0	2
Septal thickening	10	16.9	7
Bronchial thickening	6	15.0	1
Necrosis of lung	4	14.0	3
Acute myocarditis	4	6.5	1

Following is a summary of the organisms found in the 53 autopsies:

The Streptococcus hemolyticus was recovered in 80.7 per cent. of the cases from either the lung, pleural cavity or from the heart's blood, and from the latter source in 52 per cent. of the cultures. The Bacillus influenzæ was recovered in 5 cases, or 9.6 per cent. of the cultures, and was found in 3 cases in both the lungs and pleural cavities, in the heart's blood once and in the peritoneal cavity once. The Bacillus influenzæ was found associated with the Streptococcus hemolyticus four times and the Staphylococcus aureus once. A non-hemolytic streptococcus was recovered five times and the Staphylococcus aureus twice.

The low incidence of Bacillus influenzæ found was undoubtedly due to poor technic in handling the cultures. The large number of positive cultures obtained from the 69 cases of the second series may be ascribed to several factors: first, excision of lung tissue and direct smearing of freshly made human blood-agar plates adapted to influenza work at a reaction of 0.2 acid of phenolphthalein and containing two drops of blood to 200 c.c. of glucose agar, meat infusion. This medium, prepared under the direction of Lieut. C. G. Dennett, gave more positive cultures than the laked rabbit blood previously used.

It should be noted that the cultures reported as Bacillus influenzæ did not grow as typical dewdrop colonies as described by Pfeiffer and others. The colonies were less definitely outlined, slightly granular in the center, suggesting a faint opaquish color. There was no growth on plain agar. The bacilli varied in size from a cocco bacillus to a rod of slightly larger than the typical Pfeiffer bacillus in the original culture. Mannite, sucrose and lactose were not fermented. One cubic centimeter of moderately heavy emulsion was not lethal to either mice or guinea-pigs.

By order of the division surgeon all postmortem examinations were discontinued October 11, 1918. At this time the large number, over 1500, desperately sick men and the exceedingly high daily death-rate urgently bespoke what aid the laboratory might give during the emergency. To this end convalescent serum and solutions of glucose, formalin and peptone were prepared in considerable quantities for intravenous use.

REPORT ON 69 INFLUENZA PNEUMONIA AUTOPSIES.

From October 23, 1918, when permission was received to resume the postmortem work, to December 1, 1918, 69 necropsies were made on cases dying from epidemic pneumonia or from the septic processes following it. The following table shows the postmortem findings:

		Per cent.
Pneumonias:		
Broncho-interstitial	26	37.6
Lobular	27	39.2
Mixed	14	21.7
Lobar	2	2.9
	69	100.0
Empyemas:		
Bilateral	21	43.7
Right	19	39.6
Left	8	16.7
	48	100.0
Infected serosanguineous pleuritis:		
Bilateral	0	0.0
Right	2	66.7
Left	1	33.3
	3	100.0

Of the 21 cases dying without empyema, 11 died within two weeks from the onset of the first symptoms, the average duration being seven days; the extremes being one to twelve days; the 10 dying later than fourteen days averaged twenty-four days; extremes fifteen to fifty-four days. Eleven of the 48 empyema cases lived an average of eleven days, extremes five to fourteen days. The remaining 37 cases averaged thirty-two days; extremes seventeen to seventy-two days.

The following table shows the complications that occurred in 69 cases:

Acute nephritis	67
Acute adrenalitis	45
Acute splenic tumor	39
Pericarditis	20
Mediastinitis	19
Septal thickening	18
Necrosis of lung	17
Pleural pockets of pus	17
Bronchial thickening	8
Myocarditis	8
Peritonitis	6
Interlobular pockets of pus	11

Bacteriology of 69 cases:

Organism.	Number of cases.	Per cent.
Hemolytic streptococcus	41	59.4
Bacillus influenzæ	34	49.3
Non-hemolytic streptococcus	17	24.6
Hemolytic staphylococcus	13	18.9
Type I pneumococcus	1	1.5
Type II pneumococcus	2	2.9
Type III pneumococcus	4	5.8
Type IV pneumococcus	1	1.5

REPORT ON 122 INFLUENZA-PNEUMONIA AUTOPSIES WITH COMPLICATIONS.

Table "A," showing the types of pneumonia in 122 cases:

	Broncho-interstitial.	Lobular.	Mixed.	Lobar.
69	26	27	14	2
53	23	18	10	2
122	49	45	24	4

Table "B," showing the types of pneumonia associated with empyema.

	Broncho-interstitial.	Lobular.	Mixed.	Lobar.
69	21	17	7	2
53	16	4	3	1
122	36	21	10	3

Total, 70.

Table "C," showing the duration of disease in 52 out of 122 cases dying without empyema:

37 died within 14 days	Average, 7 days	Extremes, 1 to 13 days.
15 died in 15 days or later	Average, 25 days	Extremes, 14 to 72 days.

24 of the 37 cases had infected seropleuritis.

Table "D," showing type of pneumonia with five lobes involved in 37 cases dying within fourteen days without empyema.

	Cases.	Number with five lobes.
Lobular	22	15
Broncho-interstitial	8	7
Mixed	7	6
	37	28

Table "E," showing 15 cases dying over fourteen days without empyema and their complications; 122 cases.

	Cases.
Lobular	3
Broncho-interstitial	5
Mixed	6
Lobar	1
	15

Complications:

4 died on sixteenth day uncomplicated with pus processes.
1 died on fifty-fourth day with pericarditis and peritonitis.
1 died on nineteenth day with lung abscesses, psoas abscess, purulent nephritis and peritonitis.
1 died on fifteenth day with acute myocarditis.
1 died on twenty-eighth day with lung necrosis.
1 died on twenty-fourth day with septal pockets of pus, lung abscesses, hepatic abscess.
1 died on fifty-fourth day with lung necrosis.
1 died on thirty-fourth day with multiple subcutaneous abscesses.
1 died on fifteenth day with acute muco-enteritis.
1 died on twenty-third day with myocarditis and leptomeningitis.
1 died on eighteenth day with lung abscesses.
1 died on twenty-third day with purulent pericarditis.

15 Total.

Table "F," showing type of pneumonia in 31 out of 122 cases with empyema dying fourteen days and less and number with five lobes involved.

	Cases.	Number with five lobes.
Lobular	11	8
Broncho-interstitial	16	5
Mixed	4	2
	31	15

Table "G," showing type of pneumonia, all cases, dying in less than fourteen days; 122 cases.

	Cases.	Number with five lobes.
Lobular	33	23
Broncho-interstitial	24	12
Mixed	11	8
	68	43

Table "H," shows all complications in 122 cases. All cases had acute tracheitis and bronchitis, varying in severity from moderate to hemorrhagic, resulting in one case in a tracheal ulcer. All cases showed enlarged bronchotracheal lymph nodes.

	Cases.
Parenchymatous degeneration of kidneys	110
Acute adrenalitis	73
Acute splenic tumor	68
Pericarditis	29
Mediastinitis	38
Peritonitis	12
Septal thickening, average twenty days, extremes six to fifty-nine days	22
Peribronchial thickening, average twenty days, extremes eight to fifty-nine days	13
Lung necrosis, average twenty-two days, extremes six to fifty-five days.	16
Myocarditis	12
Lung abscess, average twenty-one days, extremes six to fifty-three days	11
Pleural pus pockets	17
Interlobar pus pockets	11
Tubercular bronchopulmonary lymphadenitis, or 10.6 per cent.	13
Tuberculosis of lungs	8
Adrenal hematoma, one lived four days, the other seventy-two days	2
Arthritis and multiple skin abscesses lived an average of twenty-two days	4
Acute duodenitis, lived ten days.	
Acute enteritis, lived seven days.	
Meningitis, one pneumococcus Type IV and one pneumococcus Type I	2
Infarcts of kidneys	2

Two cases with esophageal ulcer lived an average of six days; 1 case with edema of the glottis lived sixteen days.

Two cases with vegetative endocarditis. One a meningitis pneumococcus, Type IV, died on the twenty-fourth day of the disease and four days after symptoms of meningitis appeared, showed at autopsy: leptomeningitis, left empyema, broncho-interstitial pneumonia, acute vegetative endocarditis and infarcts of the kidney. Staphylococcus aureus and bacillus influenzæ were found in cultures from heart's blood and pleural fluid. The second case, 367, had a lobar pneumonia, and the autopsy findings may be found under that heading.

MEDIASTINITIS.

This complication occurred 38 times, or in about 31 per cent. of the 122 cases, was associated 32 times with empyema and in about 50 per cent. of the cases it occurred before the fourteenth day; the average being twenty-seven days, with extremes of four to seventy-

two days. Moderate widening of the mediastinal space with crepitation occurred with the mild cases; the more severe disturbances resulted in small pus pockets in either the anterior or posterior mediastinal spaces. The 3 cases showing general subcutaneous emphysema of the face and neck to Poupart's ligament were associated with mediastinitis and took their origin probably from a pulmonary interstitial emphysema. The alveolar air escaping into the interstitial tissue between the alveoli, because of increased alveolar pressure due to violent coughing, extended to the base of the lung and by this path eventually reached the subcutaneous tissue of the neck and trunk.

PERICARDITIS.

Cases.	Number.	With empyema.	With mediastinitis.
69	20	18	13
53	9	4	2
122	29	22	15

Twelve, or 41 per cent., occurred in fourteen days or less, the earliest being four days. Seventeen, or 59 per cent., occurred after fourteen days and averaged thirty-five days.

Pericarditis was found from the fourth to the fifty-ninth day of the disease. This complication probably resulted from infection by continuity and in most cases was associated with other pus processes, such as empyema and mediastinitis. The cases occurring late often had 400 to 500 c.c. of pus, with fibrin and marked thickening of the pericardium. The earlier cases showed roughening of the pericardium, with punctate hemorrhagic areas.

PERITONITIS.

The 12 cases with peritonitis averaged seventeen days, with extremes of six to fifty-four days. Of the 12 cases which lived an average of seventeen days, 3 occurred with empyema bilateral; 3 with empyema right, 3 with empyema left and 1 with a lung abscess and perinephritis and 2 were associated with operative procedures.

TUBERCULOSIS.

Fourteen cases, or 11.4 per cent. of the cases, showed evidence of tuberculosis. Of this number, thirteen, or 10.6 per cent., had bronchopulmonary lymphadenitis, and eight, or 6.5 per cent., pulmonary lesions which occurred in both lungs in 4 cases. There were four tuberculous abscesses and one miliary case, with foci in the liver and spleen.

LOBAR PNEUMONIA.

There were 4 cases at autopsy showing the lobar types of consolidation. Case 317, sick eight days, showed at autopsy: lobar pneumonia of the left lower lobe, left upper lobe and all lobes on the right side showed consolidation of the lobular type. There was an infected serosanguineous pleuritis bilateral and a hematoma of the right rectus muscle. Pleural fluid showed a hemolytic streptococcus and the lung puncture a non-hemolytic streptococcus.

Case 287, sick forty-three days, entered the hospital late in August, gave rise to great difficulty in differential diagnosis from typhoid, malaria and tuberculosis. Patient died October 8, 1918; and showed at autopsy a partially resolved lobar pneumonia, left, both lobes; interstitial bronchopneumonia, right, all lobes; empyema, purulent obliterative pericarditis and peritonitis. Hemolytic streptococcus was found in the pleural fluid and peritoneum.

Case 340, sick twenty-six days with a continuous temperature, showed at autopsy: Lobar pneumonia, left, both lobes; acute serous pericarditis; acute purulent mediastinitis and bilateral empyema. Heart's blood, left pleural fluid and right lung, showed pneumococcus Type IV. The left lung showed hemolytic streptococcus and the right lung Bacillus influenzæ.

Case 367, sick thirty-six days, developed symptoms of meningitis on the thirty-fourth day after onset. Type I pneumococcus was isolated from the spinal fluid. Case showed at autopsy: purulent tracheitis and bronchitis, lobar pneumonia, right lower lobe; solitary tubercle, left upper lobe; vegetative endocarditis tricuspid and mitral valves; septic infarcts of left kidney; purulent leptomeningitis; hemorrhagic infarcts of the lung, empyema and localized pleural abscess, right. Heart's blood, pleural fluid and lung cultures showed pneumococcus Type I. Right lung showed non-hemolytic streptococcus and Bacillus influenzæ. Sputum showed Bacillus influenzæ, Type IV pneumococcus, hemolytic streptococcus and non-hemolytic streptococcus.

The bacteriological findings, the multiple septic foci and the duration of the disease in 3 of the 4 cases strongly suggests extensive lobular consolidation rather than a true lobar form. Case 367 strongly points to the pneumococcus as a possible tertiary invader.

CAUSE OF PNEUMONIA.

The influenza-like infection rapidly passes from the nasopharyngeal portal to the trachea and medium-sized bronchi, at which point the disease may entirely cease, completing the picture of uncomplicated influenza. Further rapid extension downward through the finer bronchial tree to the bronchioles, infundibuli and alveoli, an invasion of the pneumonic field, result in those cases

recovering in three or four days. In localized areas of bloody serous exudate into the alveolar spaces the tissues escape marked injury and further bacterial invasion with the secondary bacterial flora does not occur.

But those more seriously ill and in those cases ending fatally from either the influenzal virus alone or from the secondary septic process the alveolar walls sustain a more intense injury, and in addition to the bloody serous exudate the alveolar walls are found markedly thickened, portions of them staining lightly or not at all with hematoxylin, suggesting areas of necrosis.

Upon this damaged area the secondary invaders find a fertile field to propagate rapidly and produce intrapulmonary areas of consolidation and interlobular infiltrations and by extension through the lymph channels to the pleural surfaces produce the extrapulmonary lesions, empyema and mediastinitis.

NOTES ON 108 PNEUMONIAS ENDING IN RECOVERY.

The temperature curves of the 108 cases reported in Charts I, II and III were so irregular in character that it was found impossible to give an adequate picture without building a composite chart showing highest daily elevation based on the day of onset of the first symptoms and then inserting along the base line of each chart a curve showing the number of cases having a normal temperature by day of disease. To illustrate: Case 344 on the third, fourth, sixth and ninth days had a normal temperature; died on the twentieth day with peritonitis, empyema and broncho-interstitial pneumonia, both lower lobes resolving; with hemolytic streptococcus and Bacillus influenza in the lung. This case also illustrates the interesting fact that pneumonia may develop insidiously with pulse curve at 80, respiration 18, temperature as noted above and partially resolve, the secondary invader causing death on the twentieth day.

Chart I shows temperature curve, pulse curve, blood-count curve and days of normal temperature curve of the 15 cases out of 108 cases of pneumonia which reached a normal temperature by the eleventh day—the blood counts averaging between 7000 and 9000. This is probably typical of those pneumonias uncomplicated with beginning sepsis.

Chart II illustrates curves in which a normal level was reached by the nineteenth day. Note that between the sixth and the twenty-first days the white-blood count remains between 10,000 and 15,000, which when correlated with the slightly prolonged temperature curves may be interpreted as meaning moderate sepsis.

Chart III, with 78 cases returning to duty, shows a continual febrile period of forty-five days, of which thirty-five days are indicative of sepsis.

Table "E," page 221, suggests the possible foci of infection, as peribronchial, septal, mediastinal, lung abscesses, interlobular spaces, pleura, etc.

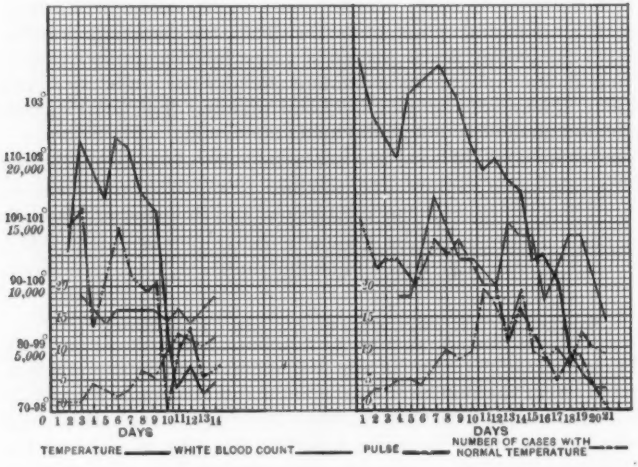

CHART I CHART II

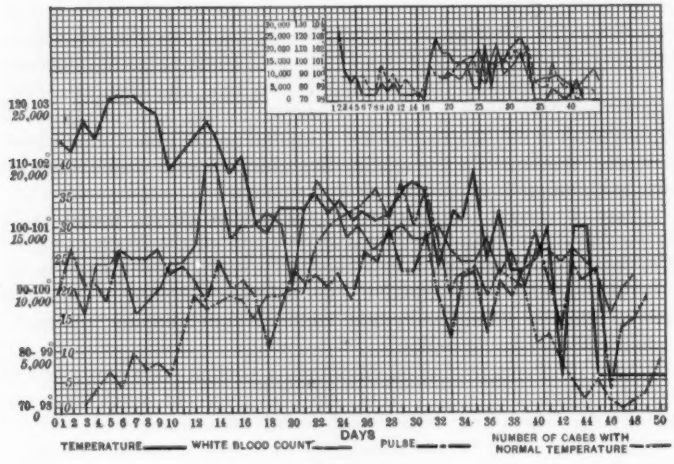

CHART III

If Chart I is accepted as typical of the uncomplicated pneumonic stage, Charts II and III clearly point to the beginning of

septic foci in some cases as early as the third day of the disease, and in this chart as well as in Charts IV and V, numerous cases on careful analysis show the septic process starting during the primary pneumonic stage. From this time to the sixteenth to the twentieth days, and in some cases at a still later date, sudden elevation of white counts and temperature showed the eruption of a focus of infection previously quiescent for days. This composite chart is misleading, in that it features the continuous elevation which is by no means the case. The first convalescent case studied had twenty-two days of elevated temperature and twenty days of normal temperature during his sickness of forty-two days, which is shown in Chart III.

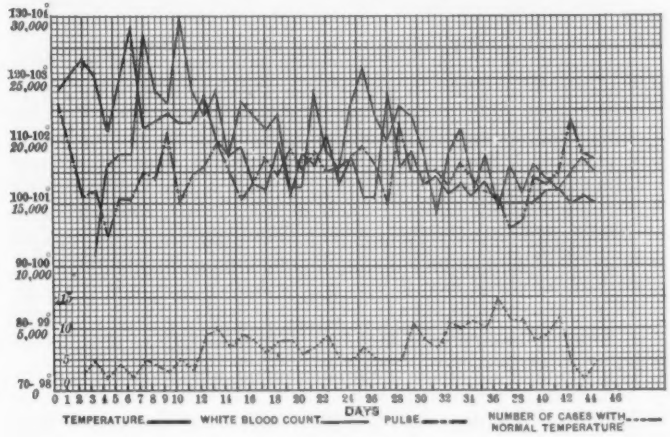

CHART IV

Chart IV graphically pictures beginning sepsis on the fifth day in forty-one empyema cases returning to duty. A study of this chart and autopsy tables permits the following deductions: Empyema may occur on any day of the disease. Of the 48 empyemas coming to autopsy in the second series of 69 cases, 20 were diagnosed antemortem from the eleventh day of the disease to the twenty-ninth day, the average being the twentieth day and the average number of days of life after the diagnosis was made was eleven; extremes one to twenty-eight days.

The broncho-interstitial type of pneumonia was more frequently associated with empyema than the lobular type.

Table "B," page 220, shows that in 70 cases of empyema the broncho-interstitial pneumonia occurred thirty-six times, the lobular twenty-one, the mixed ten and the lobar three times.

Case 326 is interesting as showing how a small area of lobular pneumonia, 6 cm. by 5 cm., indirectly caused death. Private M.,

admitted on the first day of the disease, had a temperature of 102°, pulse 102; had a normal temperature on the fourth and fifth days and died on the thirteenth day, after having had a continuous temperature for six days from empyema. Autopsy showed a small area of lobular consolidation in the right upper lobe directly below the pleura and 2500 c.c. of pus in the right pleural cavity.

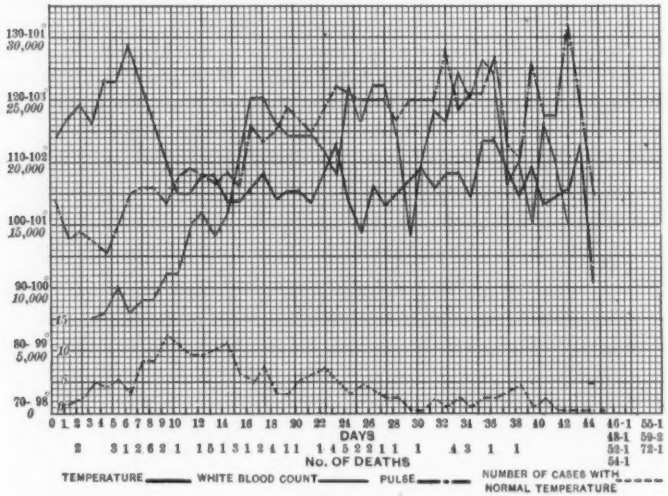

CHART V

Chart V, of 79 cases ending fatally, points to the early rise in pulse-rate to above 100 by the sixth day and its further elevation to 110 by the sixteenth day, and so on. The curve showing the number of cases with normal temperature is of particular interest in this chart from the tenth to fifteenth days, indicating that there was an average of 10 cases with a normal temperature lasting five days.

REPORT ON 3600 BLOOD COUNTS.

During the influenza and pneumonia period the white blood counts averaged low, 7000 to 9000 in those cases uncomplicated with beginning sepsis, indicating that the organism causing the infection belongs to the group of organisms not producing a leukocytosis. In the 108 pneumonia cases, Charts I, II and III, a leukopenia of 5000 to 6000 was found in 18 cases, with a continued temperature of more than fifteen days, which is interpreted as meaning that the secondary invaders were not active enough to produce either a leukocytosis or marked systemic symptoms in these cases.

All empyemas were associated with a leukocytosis; cases dying on the seventh to eight day frequently showed a low count until

twenty-four hours before death, then a sudden elevation to 15,000 to 25,000 occurred.

Numerous counts showing sudden changes from 10,000 to 30,000 to 60,000 were noted and were attributed to the rapid accumulation of pus, usually an empyema or to a small pocket of pus, either intrapulmonary or extrapulmonary, under tension. Counts of 15,000 to 30,000 found during the septic stage, indicated sepsis and were found to be compatible with recovery without empyema.

Case No. 14; following an influenzal pneumonia the temperature was normal on the twelfth and thirteenth days, followed by an irregular, moderately high temperature for three months, was diagnosed empyema on the thirty-fourth day. Counts ranged from 37,000 to 65,000 during a ten-day period and on one occasion a change of 30,000 occurred in twenty-four hours.

Case 45 died on the fifty-first day of illness from pericarditis, mediastinal abscess and empyema. Counts from the twenty-first to the thirty-first day ranged from 26,000 to 75,000, with one twenty-four hour change of 24,000.

So insidious was the septic process in some cases that the period at which the patient might be safely discharged from the hospital became very uncertain. For this reason patients with counts over 10,000 remained under observation. The first 100 cases, when clinically ready for discharge, showed 41 with blood counts between 5000 and 10,000. Forty-five had counts ranging between 11,000 and 15,000, and 14 were counted over 15,000, the highest being 21,000.

Case 162, following a mild pneumonia, had a normal temperature on the twenty-fifth day which continued normal to the fifty-first day, the day of his discharge from the hospital, the counts being 22,400 to 12,000. The blood count on the day of discharge was 12,400. Patient was readmitted ten days later, and seven days after date of admittance died with a serofibrinous pericarditis; loculated pus pocket, left pleural cavity; mediastinitis and hematoma of adrenal.

Cases of chronic sepsis developing after a mild influenzal infection were suspected on several occasions of being malaria, typhoid or tuberculosis, because of the irregular temperature elevation occurring at three- and five-day intervals, lasting two or three days. In these cases the leukocyte count showed 10,000 to 15,000, indicating a septic focus, which in 2 cases was found at autopsy and in one with the roentgen ray. Sufficient evidence was found to place the semiquiescent intra- or extrapulmonary pus foci following influenzal infections in the group of focal infections.

CAUSE OF DEATH.

Pneumonia: Sepsis. Analysis of the tables on pages 4 and 5 shows that of the 37 cases dying without empyema in fourteen days

or less 28 had five lobes involved and 22 of the 37 cases were of the lobular type. On adding to this number the 7 cases of mixed type with extensive lobular involvement the result, 29 with the lobular type, points to the lobular form as the most fatal, being present in 80 per cent. of the cases dying without empyema within fourteen days.

In the 31 cases of empyema dying in fourteen days and less; average of eleven days; both pneumonia and empyema are probably equally responsible for the fatal issue. Death occurring past the twentieth day was due in most cases to sepsis.

Sudden Death. Three of the 122 cases died suddenly. Case 357 was found dead in his barracks by the captain while making his night rounds. The second case (386) died suddenly in a neighboring city and was sick but a few hours with severe abdominal pain and vomiting. Both cases at autopsy showed marked tracheitis, enlarged pulmonary bronchial lymph nodes, pulmonary edema and acute nephritis, and on microscopic examinations, extensive exudation of coagulable material and many areas with alveolar infiltration with round cells, red blood cells and fibrin. Death in these cases was undoubtedly due to an overwhelming toxemia. The third case, one-half hour before death, complained of pericardial pain and vomited. Autopsy showed 2700 c.c. of pus and fibrin in the left pleural cavity; consolidation of the lobular type resolving in the left lower lobe and extensive lung necrosis.

Miscellaneous Bacteriology. The hemolytic streptococcus was isolated from the blood 15 times in 12 cases. Of these 12 cases 6 returned to duty; 3 cases developed empyema and 3 died.

Pneumococcus Type IV was found 14 times in 9 cases and all died.

Staphylococcus aureus was cultured 7 times from the blood stream; 3 developed empyema and 4 died. The staphylococcus was not found in the 2 cases coming to autopsy.

Non-hemolytic short-chain streptococcus was found in the blood cultures three times. Two returned to duty and 1 died.

Pneumococcus Type III occurred in three cultures and all returned to duty.

Two cases with pneumococcus Type I in the blood stream died and 1 with pneumococcus Type II also succumbed.

In all, 63 positive cultures were obtained from 310 specimens.

PLEURAL FLUIDS.

Table "I" of 158 pleural fluids from 75 cases.

	Number of times isolated.	Per cent.
Hemolytic streptococcus	74	46.8
Bacillus influenzæ	14	8.9
Hemolytic staphylococcus	22	13.9
Non-hemolytic streptococcus	12	7.6
Pneumococcus Type I	12	7.6
Pneumococcus Type III	8	5.1
Pneumococcus Type IV	5	3.2

SPUTA.

In most of the cases during the pneumonic stage the sputum was composed mostly of mucus, at times blood-tinged and exceedingly unsatisfactory to work with.

Four hundred and fifty-eight sputa were typed during the epidemic. Of these 31.8 per cent. gave the hemolytic streptococcus; 41 per cent. non-hemolytic streptococcus; 23.4 per cent. Bacillus influenzæ. The pneumococcus type follows, showing the method used in typing:

	Type I.	II.	IIa	III.	IV.
Mouse method . . .	11	3	1	5	13
Avery method . . .	7	8	9	11	100
	18	11	10	16	113

NASOPHARYNGEAL CULTURES.

Experience points to the tonsillar region and the postpharyngeal space as the areas yielding early and fairly reliable evidence as to the character of infection.

The following table shows the prevalence of hemolytic streptococcus and Bacillus influenzæ by months:

	Cases.	Per cent. of hemolytic streptococcus.	Cases.	Per cent. of influenza.
September	312	34.25	152	66.00
October	147	25.33	82	27.00
November	640	34.51	464	51.41

November 29, 1918, 57 cases in the tuberculosis ward showed 30 per cent. hemolytic streptococcus and 59 per cent. Bacillus influenzæ.

December 12, 1918, 55 overseas men arrived at the Base Hospital. Cultures showed 7 per cent. hemolytic streptococcus and 45 per cent. Bacillus influenzæ.

SUMMARY.

Three phases or stages of the epidemic were observed:

1. Influenza uncomplicated; average duration four days.
2. Influenzal pneumonia; duration twenty-four hours to six days.
3. Septic stage; duration a few days to two months or more.

Stages were not, as a rule, sharply defined, but always occurred in the order set down.

Infection is from above downward through the bronchial tree. The Gram-negative bacillus described may be the causal factor in producing the influenza and influenzal pneumonia, but sufficient evidence is not at hand to establish this, and cause undetermined will therefore be written in. The septic stage is caused by one of the secondary invaders, Streptococcus hemolyticus, non-hemolytic streptococcus, staphylococcus or pneumonia group.

No marked leukopenia was observed. Moderate leukopenia in the extremely sick pneumonias almost invariably changed to a considerable leukocytosis before death in those cases where pus was

found at autopsy. A moderate to a high leukocytosis indicated a secondary sepsis; 93 of 108 charted pneumonia cases without empyema showed evidence of sepsis.

The reason for the marked cyanosis, observed clinically, was found to be extensive lung consolidation, which with the large amount of coagulable material found in the alveoli surrounding scattered areas of consolidation must have made proper aëration of the blood extremely difficult. The three cases of sudden death reported not only point out the extremes of the pathological process but are also of medicolegal importance.

CLINICAL ASPECTS OF PNEUMONIA FOLLOWING INFLUENZA, CAMP DODGE, IOWA, 1918.

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1. The statements and conclusions of this report are based on a study of the charts of 274 patients and on personal experience during the epidemic. All the patients included in the formal review of 274 charts were admitted to the hospital in the first five days of the epidemic; we feel that this ensures a study of the typical cases, as the atypical cases are more likely to be seen as an epidemic subsides.

Of the 274 patients whose histories were studied 212 were white, 61 negro and 1 Indian; all were admitted to the hospital with influenza, except 4; in these 4 the history pointed to a prior influenza, but pneumonia was present on admission.

The symptoms and course of the influenza were first studied. The onset is almost always sudden; in 100 charts the definite statement of a sudden onset is made; in 24 the onset is said to have been gradual; but among these 24 many were found in whom it appeared that the patient had not been quite well for a while, had suffered with a "cold," for instance, yet the definite symptoms of influenza had appeared quite suddenly: moreover, even the charts that contained no statement as to the abruptness of onset usually stated the history in a way to warrant the inference of suddenness in onset. Finally, of the 274 patients only 30 stated that they had been sick more than four days; 35 were admitted to the hospital within twenty-four hours of the first symptoms, 111 on the second day, 45 on the third and 17 on the fourth day.

Headache was the most common complaint; it was mentioned 206 times, often being spoken of as severe and the most distressing symptom. Cough was complained of in 194 cases; 3 times it was described as dry, 3 times as associated with a mucous or mucopurulent sputum; in 61 cases the cough was characterized as slight;

chills or chilly sensations were recorded 149 times; history of a definite chill was only found in 12 cases; conjunctivitis, described as smarting or burning of the eyes, was present in 110 cases; coryza, or "cold in the head," in 65; sore-throat in 92. General malaise, muscular pains and aches and aching in the extremities were frequently present; general muscular soreness in 74 cases, backache 92, prostration in 32 and pain in the chest, usually substernal and ascribed to the coughing in 31. Nausea was present 44 times, vomiting 14. Photophobia was noted three times; pain in the left ear and impaired hearing were the only symptoms on admission in one case; the drum membrane was red but not bulging; this patient, on admission, had a normal temperature, two days after admission the temperature was 104.6, four days later a consolidation of the right upper lobe was noted; death ensued on the following day. Epistaxis was present in 22 cases; personal observation leads us to the opinion that minor cases were ignored by the patient; a percentage of 8 is probably too low for the true incidence of nose-bleed. In 4 cases, without history of epistaxis or demonstrable pneumonia, bloody sputum was present. Three of these patients were classed as "very toxic" on admission; in 2 of these recovery by lysis occurred in one week; the third died eight days after admission. Anorexia is mentioned 8 times, but its occurrence was so universal that the only explanation to be offered for the infrequent mention of its occurrence must be that it was taken for granted; it was so nearly universal that the return of the appetite was generally regarded as one of the surest signs of convalescence. Constipation was mentioned 3 times; one patient complained of pain in the right shoulder, abdominal pain and increased frequency of the bowel movements; there was evidence, at entrance, of diffuse lobular pneumonia, but at no time was consolidation noted; death occurred eleven days after admission. No other cases of diarrhea were found. One patient, admitted on the first day of illness, was jaundiced on admission; this patient died fifteen days after admission. One case was kept for four days under observation for smallpox. Four patients, on admission, complained of abdominal pain; 2 of these suggested appendicitis, 1 being first sent to the surgical service; a third has been discussed; aside from the complaint of pain the fourth presented no abdominal findings of interest. The lungs were noted as negative in 125 cases; in 37 there were "diffuse" rales; in 6 of these the rales were described as "moist," rales over both bases were noted twice, over the right base 10 times, over the right side twice, over the left base 6 times, over the right side anteriorly once. Thus out of 184 cases in which the lung findings were recorded, 125, or 68 per cent., were negative at the first examination. The first temperature record was over 103° in 144 cases; of these 54 had a temperature between 104° and 105°; 8 had a temperature over 105°; one of these latter had a temperature at entrance, within twenty-

four hours of the onset of the symptoms, of 107°; three days later, the physical findings of pneumonia were present; fluid was later suspected, but not diagnosed; death occurred on the tenth day. In 95 cases the first temperature record was between 101° and 103°; it was below 101° 35 times. The pulse was usually slow in proportion to the temperature. Herpes was not seen.

To review the symptoms of influenza: The onset is sudden, with headache, anorexia and fever usually above 101°; chilly sensations; cough of variable degree; conjunctivitis; pharyngitis; backache; general muscular soreness and coryza. Symptoms of less frequency, but common and important, are nausea, epistaxis and pain in the chest. A marked apathy is common: delirium of a mild type is common, especially at night, when the temperature is high; it is rarely of an active type before the onset of complications. Pulse and respiration are relatively low. The mouth is likely to get into bad condition; the tongue is heavily coated, sometimes fissured and swollen; sordes are common; the breath is often very offensive.

The charts of 300 patients, discharged with the diagnosis of influenza, were studied for the following points:

1. Duration of the temperature.
2. Frequency of epistaxis.
3. Abdominal tenderness or pain.
4. Records regarding the physical findings of the lungs.
5. Bradycardia during convalescence.

Of the 300 charts studied, 24 warranted the diagnosis of pneumonia; these will be discussed later.

1. (*a*) Of the remaining 276 charts studied the temperature, at some time, was over 101° in 242, always below 101° in 19; the remainder comprised cases with a history of influenza but no temperature on admission, cases obviously not influenza, or cases discharged from the hospital before the temperature was normal.

(*b*) In the group of cases with temperature above 101°, 67 touched 101° for seven days or more, 40 for six days, 46 for five, 33 for four, 29 for three, 23 for two and 4 were permanently below 101° after the first day.

(*c*) Of the total number of cases with temperature, 31 were normal on the fifth day, 46 on the sixth, 45 on the seventh, 43 on the eighth, 30 on the ninth and 54 not until the tenth day or later.

2. Epistaxis was noted in 20 cases; bloody sputum without epistaxis in 1 case.

3. Abdominal tenderness or pain was present 18 times.

4. "Bronchitis" was recorded 5 times; diffuse rales 57 times; rales localized in the right lower lobe 3 times, in left lower 6, in right upper 3, left upper 3, "posteriorly" 3; the lungs were described as negative 196 times. The percentage of cases in which negative findings were noted is 72.3 per cent. as against 68 per cent. in the cases followed by pneumonia; the difference is not significant.

5. Bradycardia was noted in convalescence 76 times; this includes cases in which the pulse record at one or more readings was below 60; many readings under 50 were found.

It is in regard to the cases with prolonged febrile periods that argument is bound to come; essential influenza has not been regarded as associated with a febrile period lasting more than five days at the most; here we have 153 cases out of 276 showing temperatures of 101° or more for five days or longer, yet the clinicians in charge did not find evidence of pneumonia in these cases.

Of the 24 cases whose charts presented a reasonable basis for the diagnosis of pneumonia, but which were regarded throughout as influenza, 17 had temperatures of 101° or over for five days or more; of these, 10 at one time or another touched 104° and 5 others 105°; 6 of these cases had a record of bloody sputum, 2 showing rales over both lungs, posteriorly, 1 crepitant rales and questionable lung involvement, 4 moist rales over both bases, with "questionable pneumonia," 2 crepitant rales at the bases and 3 dulness over both bases. It seems reasonable to conclude that the cases which run a temperature of 101° or over for six days are pneumonic; the likelihood of pneumonia is greater when the temperature reaches 104° for a day or two, especially if this elevation of temperature occurs after the third day; and the diagnosis becomes more certain when bloody sputum is noted or fine moist or crepitant rales, localized, are discovered.

Further consideration of the temperature is interesting. Of the pneumonia cases studied, 274 in number, the temperature on admission to the hospital was 103° or over in 144 cases; in 54 of these between 104° and 105°, in 8 over 105°. A group of 127 cases of influenza showed a temperature below 101° in 20 cases, between 101° and 103° in 60 cases, between 103° and 104° in 41 cases, between 104° and 105° in 6 cases, none over 105°. Thus of 274 cases, later developing pneumonia, 62, or 22.7 per cent., had initial temperatures above 104°; of 127 cases not developing pneumonia, 6, or 4.17 per cent., had initial temperatures over 104°; evidently the initial high temperature of influenza should serve as a warning signal.

As to the relationship of the temperature curve to the onset of pneumonia, four types of unequal importance have been observed, the first two being the important ones:

1. Continued high temperature, usually with gradual development of pneumonic signs and symptoms; increasing prostration, cyanosis, rapidity of the pulse and respiration; definite findings of consolidation are likely to occur late, if at all, in these cases; the physical findings may be nothing more than dulness over both bases, with progressive involvement of the lung shown by many fine or coarse rales.

2. Secondary rise of temperature, often associated with bloody

sputum, aggravation of the prostration, increase of the cough, which becomes less after a day or two; a chill may precede this secondary rise or thoracic or abdominal pain may be associated.

3. A less frequent type, in which there is a steady decline of the temperature; this usually means a moderately extensive pneumonia, with early termination by lysis; but this same type has been observed in fatal cases.

4. An infrequent type in which the temperature curve is irregular throughout.

Differentiation between groups 1 and 2 was arbitrarily made; if the temperature did not fall below 102° the case was included in the group of continued temperatures; when the temperature fell below 102° the case was classed as one of secondary rise; with the onset of pneumonia the temperature usually rose to 103° or more; of the 274 cases, 93 showed a definite secondary rise, 117 were of the continued type; the others belonged in groups 3 and 4; even in the cases classed as continued there was likely to be a distinct rise of temperature with the onset of pneumonia, though it had continued above 102°. Other symptoms noted as associated with the onset of pneumonia were: pain in the chest in 33 cases, bloody sputum in 39, chill in 5, "more toxic" in 3, hemoptysis once, increasing cyanosis twice; in 48 instances the secondary rise of temperature evidently stimulated the search for definite evidence of pneumonia.

The physical findings, as first discovered, were variable; consolidation in the right lower lobe was noted 73 times, in the left lower 57 times, in the right middle 5, right upper 7, left upper 2, both lobes, left side, 6 times; diffuse rales over both bases were the first findings 40 times; rales about the angle of the right scapula 18 times, about the left 11 (our own experience leads us to believe that many of the cases noted as beginning with consolidation in the right or left lower lobes, probably began with rales about the lower angle of either scapula); scattered rales were noted 22 times.

In other cases, patches of consolidation, fine moist rales or typical crepitant rales were noted in various situations.

The type of pneumonia present in these cases does not usually remain confined to one lobe; the pneumonic process is progressive, ultimately involving a large part of both lungs. Physical findings at the height of the disease showed consolidation in the right lower lobe alone 64 times; right lower and middle 6 times; the entire right side in 4 cases; the left lower lobe was involved alone 45 times; the entire left side twice; in 6 cases the only findings were rales over both bases; 5 of this group of cases terminated fatally, 1 in recovery by lysis; both bases were "dull with rales" 15 times; 6 times the right lower lobe showed consolidation with rales in both bases; the left lower lobe with rales in both bases 13 times; 11 cases showed irregular bilateral involvement; 1 case showed a left upper

involvement terminating by crisis, followed a day later by involvement of the right lower; another chart contains a record that "crepitant rales in the axillary region of the right side" were present three days before death; evidently no more conclusive evidence of pneumonia was found. One record reads: "Not enough lung findings to justify diagnosis of pneumonia;" this record was made on the day before the patient's death. Another records: "Moist crepitant rales over all;" this was the last record made before the patient's death, two days later. Edema of the lungs was noted 13 times; our own experience leads us to believe that a terminal edema such as is common in ordinary lobar pneumonia was not common in this epidemic. Two points need emphasis:

1. At autopsy, though the signs of consolidation might have pointed clinically to the involvement of only certain parts of the lung, the process had actually involved much more than had been suspected.

2. Some cases at the onset were characterized by anomalous physical findings; impaired resonance, with fine moist rales, diminished fremitus and feeble breath sounds.

Epistaxis occurred 8 times in the course of the pneumonia, in cases in which it had not been present in the influenzal stage; 2 patients had hard chills in the course of the disease. These occurred independently of the administration of glucose, peptone or formalin, which was often followed by a severe reaction with a hard chill; in 40 cases delirium was noted; 36 of these patients died; obviously only the severer degrees of delirium were noted; 54 patients, of whom 42 died, were noted as cyanotic.

An irregular pulse was noted 4 times; only 1 cases of auricular fibrillation was seen personally; this was in a patient with complicating pleural effusion and pericarditis, the latter of which at autopsy proved to be frankly purulent. Some of the instances of recorded irregularities of the pulse were probably incorrect; it was easy to fail to perceive beats when the pulse became very weak and rapid. One patient had very marked drenching sweats; another had persistent vomiting. In the 274 cases frontal sinusitis occurred once, otitis media 4 times. Hoarseness was noted three times; edema of both eyelids once: abdominal distention 4 times; icterus 5 times, an incidence of 2 per cent. Involuntaries were noted but once; urinary retention was more common, 3 patients requiring catheterization.

There were records of urinary examination in 42 cases; 13 of these were negative; the others showed, generally, a high specific gravity, with albumin and casts, hyaline and granular; red cells were noted once; of the patients with negative urines, 5 recovered; a single urinary examination evidently has no prognostic value.

The onset of the pneumonia as determined by the secondary rise of temperature, the occurrence of a presenting symptom, as pleuritic

pain or bloody sputum, or the discovery of physical findings, dated from the onset of influenza, as stated by the patient, occurred as follows: in 3 cases within twenty-four hours, 19 times on the second day, 24 times on the third, 44 times on the fourth, 41 times on the fifth, 41 times on the sixth, 32 times on the seventh, 25 times on the eighth, 22 times on the ninth and 13 times later than the ninth day; out of 264 cases in which the onset of the pneumonia could be determined with a fair degree of accuracy, 126, or 47.7 per cent., began on the fourth to sixth days inclusive; including the incidence on the third day, 56.8 per cent. began on the third to sixth inclusive; in 172, or 65.2 per cent., the onset was before the seventh day after the onset of the initial symptoms of influenza.

COMPLICATIONS. Thirty-three cases showed severe pain in the chest, probably due to pleuritis: in 8 cases severe abdominal pain was noted; in one of these there was an associated diarrhea; the others were probably referred from a pleuritis, making together 40 cases of pleuritis; to these must be added 4 cases "of thickened pleura," one with a friction rub but no pain and 3 with fluid without pain, a total of 48 cases of pleuritis, a percentage of 17.5 per cent. Pleural effusion was diagnosed and proved by aspiration 9 times; it was probably overlooked several times; "thickened pleura" was diagnosed 4 times; in only one of these 4 cases was aspiration done; autopsy experience does not warrant the diagnosis "thickened pleura" in a disease of such short duration, occurring in otherwise healthy young men; the pleura was not sufficiently thickened to interfere perceptibly with the transmission of voice and breath sounds or of fremitus in any of the cases which came to autopsy early. In another case the record shows that "fluid" is suspected; four days later "the symptoms of beginning resolution are present;" on the following day this patient died. Again, after several days of sickness, physical findings of pneumonia are "less pronounced" only three days before the patient's death; in another case, four days after admission and four days before the patient's death, we find voice and breath sounds diminished when they had been previously exaggerated; in a further instance, two days after crepitant rales had been heard, the record reads, "Right side flat; distant breath sounds."

These cases are cited to emphasize the danger of overlooking this serious complication. The accepted signs of pleural effusion are modified, not abrogated; flatness, absence or diminution of voice or breath sounds, or of tactile fremitus, egophony, Grocco's sign, displacement of the heart are as important here as elsewhere; but breath and voice sounds increased by consolidation will be heard through fluid. The dulness is likely to be shifting in character, adhesions are not found early, and thus is explained the frequent occurrence of "movable" dulness. Rales were often heard through fluid. The diminution of the tactile fremitus, in our experience,

was the most valuable sign, especially if found over an area of confluent pneumonia which had previously shown increased fremitus; it is of great importance also if diminished fremitus is found in association with increased voice and breath sounds. Distant tubular breathing was frequently heard through fluid, and the diminution of fremitus with the continued presence of increased voice or breath sounds, or without them, over an area in which they had once been distinct, was of the utmost importance. The diagnosis of resolving pneumonia, because of the disappearance of the characteristic pneumonic findings, while the patient is still obviously sick, should be made with the greatest of caution; it is likely that a complicating empyema has caused the change in physical findings. The presence of a definite leukocytosis before the discovery of physical findings is suggestive; after their discovery it is a valuable confirmatory sign, though the presence of leukocytosis does not necessarily mean pleural effusion; it occurs with other complications or without them. In the use of the term "definite leukocytosis" a count of 15,000 or above may be accepted as an arbitrary limit.

Pericarditis sicca and with effusion occurred in several cases: in one case the discovery of the rub was preceded for one day by pain in the left shoulder. Endocarditis was rare.

Symptoms pointing to an abdominal lesion were seen in 8 cases; 4 have been discussed; of the remaining 4, 1 required differentiation from appendicitis, 1 had pain chiefly confined to the pit of the stomach, of which no further mention was made; 1 had no further record than of severe abdominal pain; the fourth died with the symptoms of peritonitis, "abdominal tenderness, distention, rigidity and vomiting, complicating a pneumonia and empyema."

The 274 cases studied did not present all of the complications seen during the epidemic, and the records made in the rush of extraordinary work are not always complete; to give a better picture of the many complications incident to the disease we must make use of our experience, fragmentary and incomplete as that may be.

As to the incidence of complications affecting the ears, eyes, nose and throat we quote the following personal report of Captain Kent E. Williams, of the Head Surgery Department; this report includes all complications of this nature occurring in influenza and pneumonia patients seen by him September 29 to October 20 inclusive:

Otitis media suppurativa chronica	10
Otitis media (simple) non-suppurativa	275
Otitis externa hemorrhagica	120
Laryngitis, acute	76
Sinusitis, acute	36
Tonsillitis and pharyngitis, acute	200
Epistaxis	217
Conjunctivitis, acute	27

Captain F. M. Manson, of the Surgical Service, reports that during the epidemic 105 cases of pleural effusion were seen; 64 of

these patients are still in the hospital; 41 have died, a mortality thus far of 39 per cent. of the cases of pneumonia complicated with empyema. Early the effusion is seropurulent; later it becomes distinctly purulent. Empyemata localized to the region of one or the other upper lobes have been diagnosed and aspirated; in these cases the roentgen rays are of particular value. Abscesses have been found in the mediastinum several times at autopsy; the report from the director of the laboratory describes them.

The relationship of tuberculosis to the prevalent influenza and pneumonia is still uncertain; several cases of simultaneous occurrence of the two diseases have been seen clinically and at autopsy; what influence the present epidemic may have in predisposing to tuberculosis is a problem for future work.

Subcutaneous emphysema, beginning in the tissue of the neck and upper part of the thorax, was seen in several cases; in some instances the process spread over the entire trunk, even involving the arms; in 1 case the scrotum was involved, Only 3 patients are known to have recovered; 3 went to autopsy; the report from the pathological department will discuss the origin and pathogenesis of this complication. In general it was found only in cases of the most severe type.

Meningitis was seen 5 times; 4 of the cases showed pneumococcus in the spinal fluid. None of these recovered. In another case, coming on after the subsidence of the pneumonia, spinal fluid showed a positive Wassermann; recovery followed under appropriate treatment.

Two cases of persistent singultus were found; in both cases this symptom preceded the development of frank pneumonia. Another patient had "coffee-ground" vomitus in the forty-eight hours just preceding death; autopsy revealed a ruptured esophageal ulcer, probably secondary to an extensive suppurative mediastinitis. One other case of ruptured esophageal ulcer was seen at autopsy.

Two cases of multiple arthritis were seen; in 1 of these endocarditis developed: in 2 other instances septic arthritis was found at auptopsy. Thrombophlebitis of the femoral veins was seen a number of times; in 1 case it was bilateral.

There were 2 cases of severe pulmonary hemorrhage; 1 patient died in a short time; the other has since presented one of the few cases of empyema located over an upper lobe, which has been drained, and the patient's condition is good.

Lieut. Ramsay, of the contagious wards, reports 14 cases of erysipelas in pneumonia and influenza patients; 12 recovered. One of these patients, thirteen days after admission with a severe pneumonia, when apparently improving, developed a streptococcus sore-throat, with marked edema of the uvula; facial erysipelas appeared the next day; within another twelve hours death ensued as a result of edema of the glottis and larynx.

COURSE. Crisis occurred in 15 of the 274 cases, in all except 1 before the seventh day; the one exception had the crisis on the tenth day; 3 terminated by crisis, extending over thirty-six hours; 98 cases terminated by lysis; thus of 115 cases studied, which terminated in recovery, 14.7 per cent. terminated by crisis. In the cases terminating by lysis, return to normal temperature was most frequent from the third to the sixth day inclusive, but in 13 instances was prolonged beyond the tenth day. In the cases terminating fatally 4 died within twenty-four hours of the discovery of pneumonia, 6 on the second day, 24 on the third, 14 on the fourth, 17 on the fifth, 17 on the sixth, 10 on the seventh, 17 on the eighth, 7 on the ninth, and 2 on the tenth day; thus 121 terminated within ten days after the onset of pneumonia; 35 died after the tenth day; where empyema develops, except in the more virulent cases, the course is prolonged. An interesting feature was the discovery during examinations for discharge to convalescent barracks, after a week or more of normal temperature, that about 20 per cent. of these patients, apparently well, still presented definite physical findings of pneumonia; in a few cases quite extensive.

DIAGNOSIS. The diagnosis of pneumonia rests finally on the discovery of the essential physical findings; bloody sputum, aggravation of the general condition, chill, pain in the side or abdomen, create the suspicion of pneumonia; the temperature curve either of the continued type or showing the characteristic secondary rise is of importance; in the influenzal stage the leukocyte count is usually low; with the onset of pneumonia it is likely to increase, though this is not invariable, and in uncomplicated pneumonia, it is not often above 15,000.

The diagnosis of empyema has already been discussed at length; it may be added that the presence of a definite leukocytosis is a valuable adjunct in diagnosis. The roentgen rays are valuable, especially in localizing the effusion.

PATHOGENESIS OF THE CYANOSIS. 1. This may be due to the virulence of the infection, producing an overwhelming toxemia; this factor alone, by its action on the vasomotor center, may produce the cyanosis.

2. Autopsy showed, in many of the cases, very extensive pulmonary involvement, sufficient in itself to produce death, practically by suffocation.

3. Autopsy revealed, in a large number of cases, macroscopic changes in the adrenals; blood-pressures were not taken, so the possible effect of adrenal change on blood-pressure in these cases can only be discussed theoretically; however, it appears possible that the early collapse in many of these cases was partly the result of adrenal insufficiency.

Prognosis is uncertain; sudden change, inexplicable in the light of our present knowledge, for better or worse, is a common event.

For individuals at the same time of life the mortality is much greater, in general, than is that of the ordinary lobar pneumonia. When the pulse and respiration remain relatively low the outlook is usually good; increasing cyanosis, tendency to hemorrhage, icterus, progressive involvement of the lung, active delirium, increasing rapidity of the pulse and respiration are of bad prognostic import. It is fairly characteristic, in the fatal cases, for pulse and respiration to go up while the temperature goes down. The patient's sense of well-being is often misleading; many times the mind remains clear until near the end and the desperately sick patient will express himself as "better." Empyema is a complication of gravity; abdominal distention and the subcutaneous emphysema mentioned were only found in serious cases.

TREATMENT. The forms of special treatment employed will be discussed in the report of the chief of the medical service. The general treatment consisted of rest in bed (especially to be recommended as a prophylactic measure as the influenza subsides), fresh air (the patients were kept on the porch in favorable weather), administration of fluids and soft diet and attention to the bowels. Digitalis, strychnin and camphorated oil were extensively used; whisky was employed in some cases; none of these agents have commended themselves as of value. Codein or heroin are advised to control excessive cough; morphin to quiet delirium when the patient was obviously exhausting his strength; it is also used to give a night's restful sleep. Horse serum was used subcutaneously for the cases with a notable tendency to hemorrhage. Atropin, pituitrin and enemata, plain or of asafetida, or milk and molasses were used in the cases of abdominal distension. The mouth needs care. The treatment of empyema will be discussed by the chief of the surgical service.

CONCLUSIONS. 1. The prevailing epidemic of so-called influenza is characterized by two stages: the first, in which the symptoms are those of a severe infection of four or five days' duration, involving particularly the upper respiratory tract, and the second, coming on about the fourth to the sixth day after onset, is characterized anatomically by pneumonia of a lobular type, or of the form known as interstitial bronchopneumonia; in either case the process becomes confluent, giving the physical signs of consolidation; in its course the disease differs from lobar pneumonia of the common type in that a chill at the onset is not common and crisis is an unusual termination.

2. The pneumonia is often virulent in type, characterized by cyanosis, extreme prostration, a tendency to hemorrhage and the frequent occurrence of an early empyema.

3. Pneumonia develops usually by the sixth day of the influenza; the course of uncomplicated pneumonia is usually complete in less

than ten days; termination is by crisis in about 15 per cent. of the cases.

4. There is a tendency to complications of a septic nature; purulent accumulations occur in various situations; mediastinal abscesses, empyema, septic arthritis, muscular abscesses, otitis media have been seen; erysipelas may also be a complication.

5. Of uncertain etiology we have no rational method of treatment; the essential feature, the bacteriological causative factor, must be determined before we can look forward to specific therapy. Prophylactic measures are now the most important; these should be carried out, in the light of the established fact that the disease is transmitted by contact infection. Once the pneumonia is established we must rely on general measures of treatment.

6. It is imperative that patients should not be discharged from observation too early. Prophylaxis should include protection of the patient from exposure or undue activity for some time after apparent recovery; in view of the fact that physical findings persist for some time after the general condition is good (definite evidence of considerable fluid was found in one patient, after he had been up and about several days), and in view of the further fact that activity of every sort seems to lessen resistance to the disease, too great care can hardly be used to protect the convalescent patient from recrudescence or complications.

7. The indications for aspiration of pleural effusions are, in our opinion, not clearly defined; at the height of the pneumonia the effusion has a marked tendency to recur, causing a rapid loss of fluid when large amounts of fluid are aspirated often; after the occurrence of the subcutaneous emphysema, already noted, and the failure to discover any cause for it, except bronchial and peribronchial necrosis, we felt that caution must be used to avoid injury to the lung by means of negative pressure employed to withdraw fluid; finally, there still remains the possibility that the pleural effusion is at first a conservative process. The entire subject will be discussed in the report of Captain Manson, but we may state the indications, as they appeared to us; numbers 1 and 2 are definite indications for interference.

(*a*) The discovery of frank pus, especially after the height of the pneumonic process had passed.

(*b*) Definite evidence of mechanical embarrassment on the part of the heart.

(*c*) Small effusions early are better left alone; later if purulent they must be removed.

(*d*) Larger effusions even when displacing the heart had better be removed by repeated aspirations of 500 c.c. or thereabouts at a time.

REPORT OF THE SURGICAL SERVICE, U. S. ARMY BASE HOSPITAL, CAMP DODGE, IOWA, ON THE EPIDEMIC OF INFLUENZA OF 1918.

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The surgery of the epidemic was preëminently that of empyema, although the following surgical complications arose during the epidemic:

14 cases of mastoiditis.
105 cases of otitis media.
1 case of frontal sinusitis.
4 cases of purulent peritonitis.
2 cases of appendicitis (ruptured).
4 cases of multiple abscess.
1 case of phlegmon of the neck.
1 case of phlegmon of the chest.
1 case of ileus (mechanical).
1 case of edema of glottis.

It is considered of sufficient interest to mention that about 30 cases of pneumonia developed symptoms strongly suggestive of surgical lesions of the abdomen, which were seen in consultation with the medical service; so closely did some of these cases with chest pathology simulate appendicitis that three of the cases were transferred to the surgical wards with the diagnosis of appendicitis, but the true condition was discovered in time and none of them were operated. There were two cases of appendicitis which were operated and found to be gangrenous appendicitis, each giving a history of previous attacks of appendicitis. A third case which was diagnosed as appendicitis, and which was unoperated, died with peritonitis, which was shown to be due to a right perinephritic abscess.

The total number of empyemata, recognized by antemortem aspiration and by autopsy from the beginning of the epidemic, September 29, 1918, to December 31, 1918, was 150, an incidence of empyema to pneumonia of 1 to 13; inasmuch, however, as all autopsies were discontinued for eleven days during the height of the epidemic, it must be assumed that these figures representing the incidence of empyema to pneumonia are not sufficiently high.

The average time which intervened between the diagnosis of pneumonia and the diagnosis of empyema in the 64 treated cases in the first month of the epidemic was six days; the average time for the 41 treated cases occurring after the first month was twenty-one days and the average time for the entire series of 105 treated cases was eleven days. Many of the cases admitted into the hospital with pneumonia showed pleural effusion present at the time of

admission, and the shortest interval after admittance before the recognition of pleural effusion was one day.

The bacterial flora of the pleural fluids from the treated cases was found to be—

No. of cases showing			hemolytic streptococci	29
"	"	"	hemolytic streptococci with other organisms	19
"	"	"	non-hemolytic streptococci	4
"	"	"	non-hemolytic streptococci with other organisms	3
"	"	"	staphylococci	4
"	"	"	staphylococci with other organisms	6
"	"	"	pneumococci	11
"	"	"	pneumococci with other organisms	9
"	"	"	influenza	1
"	"	"	no growth	6
"	"	with no report		14

In 23 cases in which the streptococci were found the chains averaged 14 cocci to the chain.

Every empyema in the series was, clinically, secondary to pneumonia, except 3, and these 3 cases, in the rapidity of development of the pleural effusion, may have obscured the early pneumonia symptoms, for every case of empyema that went to autopsy revealed some pneumonic involvement.

In many respects the empyemata of the influenza epidemic resembled clinically and morphologically the empyemata of the pneumonia epidemic, which occurred at this camp during the spring of 1918, and the course in the present as in the former epidemic depended upon the virulence of the infection, the degree of pneumonic involvement and the accessibility of the pus collection for drainage. Among the early cases of the epidemic there were many of the fulminating type in which the victim was so overwhelmed with the septic process that he died in a few days after the initial chill and onset of fever, usually with fluid in one or both cavities.

The rapidity with which the fluid accumulated in some cases was remarkable; it was not uncommon to find at autopsy 1500 to 2000 c.c. of fluid, with no definite signs twenty-four hours before death. At times from 500 to 1200 c.c. would be found at autopsy in one pleural cavity, unrecognized before death, with perhaps a draining empyema on the opposite side. We have seen 1200 c.c. of turbid straw-colored fluid with streptococci in large numbers aspirated in less than twenty hours after recognition of the pleural friction rub. The character of the fluid found in the rapidly fatal cases was usually cloudy, yellowish or serosanguinous, and commonly contained small and large masses of fibrin.

In the early cases (fulminating), which occurred in the first month of the epidemic and which showed an enormous mortality, the clinical picture was usually that of a septicemia in which the empyema was but one of the concomitants of a virulent infection, and had, as commonly associated lesions, septic pneumonia, purulent

pericarditis, endocarditis, adrenalitis and purulent peritonitis. The pneumonic process exceeded by far the empyema as a factor, determining the death-rate in these fulminating cases, for at times the consolidation involved as much as four-fifths of the entire lung area. The mortality of this type, therefore, was essentially that of pneumonia, with septic complications, rather than the mortality of empyema, as we were accustomed, formerly, to regard the mortality of empyema which followed lobar pneumonia.

The mortality of the 94 cases of empyemata which occurred during the first month when the epidemic had its greatest virulency was 70 per cent.; the mortality of the 64 cases treated during this same period was 56 per cent.; the mortality of the 52 cases after October 31, 1918, was 40 per cent.; and of the 41 treated cases after October 31, 1918, was 24 per cent.; the mortality of the entire 150 treated and untreated cases was 60 per cent. The virulence of the epidemic during this period was also evident in the mortality rate for pneumonia without empyema, which was approximately 40 per cent. for October, 1918, and about 36 per cent. for the entire epidemic of pneumonia without empyema. The mortality as influenced by different methods of treatment will be discussed under treatment.

The diagnosis of empyema was often difficult, and it was impossible to lay down definite signs which would establish the presence of pus, since the classical signs of fluid were usually masked by the bizarre complex of physical signs that characterized this type of pneumonia. The signs as found during the disease could be explained at times only by the study of postmortem findings.

Frequent and regularly repeated examinations with descriptive notations were essential in the recognition of advent of the pleural effusion. When the patient was studied, with frequent examinations, the advent of pleural effusion could be recognized by dulness, flat and woody in character, by distant breath sounds, diminished or absent tactile fremitus, especially if these signs were noted first in the diaphragmatic angle and had progressively ascended. The displacement of the heart and liver often indicated effusion. Frequent measurements of the area of cardiac dulness by Cabot's method were extremely useful in the recognition of cardiac displacements and pericarditis and afforded some basis for suspecting mediastinal pus pockets. The association of dulness, absent fremitus and pectoriloquy was found to be very reliable in locating pus collections.

When the opportunity of following the development of physical signs was not afforded the diagnosis of pleural effusion became much more difficult, since the physical signs were varied and atypical: one, for instance, might find a pneumothorax with an effusion, or bronchial breathing or an increase of the whispered or spoken voice sounds over fluids; crackling rales were often heard over effusions,

especially in the cases having thick pus. The temperature and pulse might show little change. In cases occurring later after pneumonia the presence of pus is often indicated by a rise of the leukocyte count, pulse and temperature. After aspiration or drainage the interpretation of the physical signs was usually extremely unsatisfactory. The pleura frequently was covered with a heavy fibrinous exudate, and this condition was difficult to differentiate from pleural effusion, particularly if consolidated lung were back of the pleural deposit. Here the *x*-rays sometimes helped out, but frequently the only means of deciding was the aspirating needle; if the needle entering the chest continued to meet with resistance a pleural exudate or adhesions were considered present.

The *x*-rays were found to be valuable, indicating fluid, when the amount was 500 c.c. or more, in which case the rib shadows were obliterated and the costodiaphragmatic angle obscured. Contrary to our previous understanding the shadow which was cast by thick pus was lighter than that cast by serous fluid, and at times it could not be decided from the shadow cast whether or not pus was present. The shadow cast by sanguinous fluid was relatively dense. The roentgen rays were found particularly valuable in outlining pus accumulations with fibrinoplastic exudates, and showing by stereoroentgenograms the location of smaller accumulations after a chest had been aspirated. Roentgen-ray plates were valuable in demonstrating when there was collapse of the lung and also the presence of separate pus pockets. After drainage was established it was valuable in showing the extent of the collapse or expansion of the lung and the reduction in size of the cavity and the position of the drainage tube. It was of little value in diagnosing mediastinitis, as were all other diagnostic methods. Subcostosternal pus pockets and purulent mediastinitis were found in 17 per cent. of the cases at autopsy, but were seldom diagnosed before death, although their presence was at times suspected from the combination of clinical and roentgen-ray findings. Interlobar empyema occurred in about 8 per cent. of the cases and were diagnosed with no little difficulty. They were usually suspected in a patient who ran a prolonged illness with increasing temperature and high leukocyte count and in whom repeated aspirations had been negative. Here the *x*-rays were valuable in locating by stereoscopic plates the location of the empyemic cavity, which could then be more readily confirmed by the aspirating needle over areas which showed dulness with absent fremitus and pectoriloquy.

The pathology of empyema was found at autopsy to be that of bronchointerstitial or lobular or mixed lobar pneumonia, with purulent pleuritis with adhesions, unilateral in 36 cases and bilateral in 11 cases. There were 28 cases found on the right side and 19 cases on the left side; 24 cases were bilateral. Of the 105 treated cases 60 were on the right side and 45 cases were on the left side;

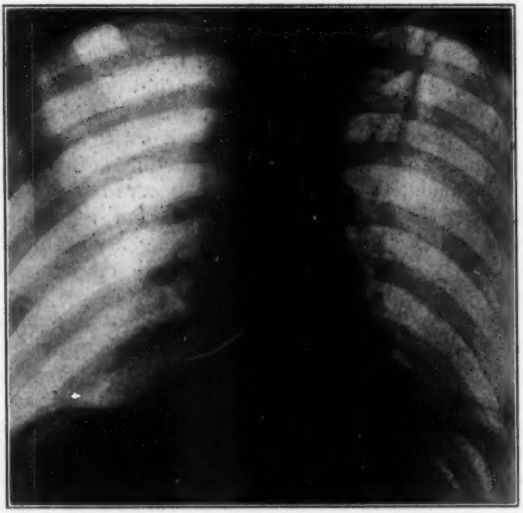

FIG. 1.—Reproduction of roentgen-ray plate fourteen days after thoracotomy, with large tube and tight closure of wound about the tube; 250 c.c. pus withdrawn at time of operation, tube connected with siphon bottles for constant negative pressure, yet large pneumothorax visible, showing that this type of drainage does not maintain constant negative pressure.

FIG. 2.—Reproduction of roentgen-ray plate, showing appearance of chest seventeen days after operation with trocar and cannula; 2250 c.c. pus were removed at the time of operation, yet the lung is expanded and there is no pneumothorax.

only 1 case was diagnosed as bilateral before death; 17 cases showed pleural pus pockets. Encapsulated pus was found in various locations in 28 cases. Pulmonary abscesses were found in 11 cases. The subcostosternal pus pcokets were situated between the edge of the affected lung and the pericardium directly under the sternum extending to one or both sides and at times communicating with an empyema cavity. They might extend to the hilus of the lung or communicate with a septic cavity back of the lung. The lymph nodes at the hilus of the lungs were swollen and soft. Purulent or serous pericarditis was found in 10 cases antemortem and 25 cases postmortem, and apparently in a few cases was secondary to mediastinitis or substernal pus pockets, and in one case (Private H.) there was a gangrenous area on the pericardium, contiguous to a gangrenous area of the lung. The striking feature of the pericarditis was the frequent massive vegetations on the heart, sometimes so abundant as to change the entire appearance of the heart; also the enormous amount of fluid in the pericardial sac (one case having 750 c.c.). Infection of the pleural cavities was though to be by direct extension through the visceral pleura; every empyema had been shown at autopsy to be associated with a pneumonic process, and definite septic infarcts, varying in size and number, were found in a few cases in the periphery of the lung; in one case both lungs appeared studded with pea-sized septic areas. While the infection seemed to spread in the chest by contiguity many cases were clinically septicemias, since they showed the association of endocarditis, phlebitis, arthritis, pericarditis, subcutaneous abscesses and other septic complications. Arthritis was seen in 3 cases antemortem, and purulent arthritis was found in 1 case; peritonitis with empyema was diagnosed in 4 cases and found in 9 cases at autopsy.

The treatment of empyema, as a result of our experiences at this base hospital in the spring epidemic, was based upon two conclusions: (1) to tide the patient, seriously ill with pneumonia and empyema, over his critical period, by one or more aspirations, thereby preserving for him all his remaining respiratory function, by avoiding a pneumothorax and collapse of the lung, also avoiding any shock from the trauma and excitement of an operation for drainage, when he was least able to stand it; (2) to maintain a continuous negative pressure in the pleural cavity while being drained, thus shortening the convalescing period by securing expansion of the lung with a constant, rapid lessening of the empyema cavity.

Approximately the first 43 cases of empyema were treated with repeated aspirations and the injection of 2 per cent. formalin glycerin, subsequent aspirations were done when the fluid reaccumulated or when there was evidence of absorption of toxins. The aspiration was done slowly with a Potain apparatus, and unless the patient showed signs of cardiac embarrassment or pains in the chest, with severe cough, indicating a possible edema of the lung, the

quantity withdrawn was not arbitrarily limited. We have seen striking benefits from the withdrawal of large amounts of fluid in patients considered *in extremis:* Private G., for example, had bilateral pneumonia, cyanosis, imperceptible pulse, cold, sweaty skin, and was so desperately ill that we hesitated to subject him to the supposed additional hazard of aspiration; but he improved immediately upon the withdrawal of 1800 c.c. of purulent fluid and is now convalescing from his empyema. Only 2 per cent. of our cases exhibited circulatory or cardiac embarrassment when aspirated. The largest amount of fluid withdrawn at one aspiration was 3200 c.c., which was done without any cardiac embarrassment. Private J., cyanotic, with marked dyspnea and very rapid pulse, was relieved immediately by withdrawing over 2000 c.c. of fluid at the first aspiration; and approximately the same amount was withdrawn on two subsequent occasions. The average amount of fluid withdrawn at the first aspiration in the entire series was 726 c.c.; the average time between aspirations was four days. In this group, which was aspirated and injected with formalin-glycerin, 13 had one aspiration, 13 had two aspirations, 12 had three aspirations, and 5 had four aspirations.

At each aspiration a specimen of the pus was sent to the laboratory for bacterial count, in order to determine the effect of the formalin-glycerin; the results, however, did not justify the conclusion that 2 per cent. formalin-glycerin in these cases showing excessive amounts of pus, was of any considerable value, and, on the other hand, it was was found that its use in the pleural cavity caused any harm.

In the group of severe and rapidly fatal cases of treated empyema (64) seen in the first month of the epidemic, 36 died, 24 had operations for drainage and 4 drained through the mouth by way of a bronchial fistula without aspiration; 11 of the empyemata that died had an average duration of five and a half days following the diagnosis of pneumonia, one died two days after diagnosis of pneumonia, confirming the opinion that the mortality of the early empyema was that of pneumonia. Many cases of the epidemic were so rapidly fatal that death occurred before aspiration could be done. One of the cases that drained through the mouth by means of a bronchial fistula suggests the danger of delaying thoracotomy on the supposition that if the patient is expectorating pus he can safely drain his empyema that way without operation, as apparently did a few others; this one patient who was expectorating considerable pus was the victim of a sudden bursting through of an accumulation of pus at night, drowning in his own pus.

Aspiration has proved of distinct value, although at the best a temporary expedient; it is indicated when the patient is in the critical stage of his pneumonia and has the additional handicap of a large pleural effusion that mechanically and through the absorption

of toxins tends to turn the balance against him. The experience of this hospital has been that rib resection or even thoracotomy at this time might be attended by a serious outcome by producing a pneumothorax and its attendant danger, collapse of the lung, with still further limitation of the already limited respiratory capacity. Repeated aspirations done early and without pain under novocain will tide the patient over to a time of increased resistance.

When the cases came to the stage of required drainage, simple thoracotomy under local anesthesia and continued negative pressure were tried in a number of cases; our method was to introduce the aspirating needle at the site selected for operation, which was usually the eighth or ninth interspace in the postaxillary line. If pus was found the aspirator was disconnected from the needle and it was left in the pus cavity as a guide for the knife. A 1 inch to 1¼ inch incision was then made along the side of the needle into the cavity and a special drainage tube inserted, the incision being sutured or packed around the tube, care being exercised at all times to prevent the entrance of air into the chest.

The special tube consisted of a heavy walled rubber tube, ⅝ inch in diameter, through which ran a Carrel tube, which entered the large tube just outside the skin level, traversed the length of the tube and again emerged through an oblique opening in the wall of the tube inside the chest. This small tube was connected with a Carrel flask for treatment with Dakin's solution, and the large tube connected with a bottle hung on the bed to receive the drainage. Negative pressure was maintained in the bottle by means of a hand pump or by connecting it with two other larger bottles, which would act as a siphon, water being siphoned from the second into the third bottle. This method seemed at first to fulfil the requirements of an ideal treatment, since the operation could be done without pain and shock; since negative pressure seemed possible and since the Carrel-Dakin treatment could be employed. Moreover, by this technic of closing the chest wall against the tube, cross-infection appeared to be eliminated and the frequent changing of dressings avoided.

The practical application of the method, however, established its defects; it was found, for example, that the large tube soon became loose in the wound and admitted air into the pleural cavity with a consequent collapse of the lung, and also drainage occurred along the side of the tube and cross-infection was possible; the tube would occasionally slip out and the method required considerable watchfulness to maintain the siphon apparatus in working order.

Twenty-nine cases were treated thus by thoracotomy with a drainage tube connected with the negative pressure apparatus. Four of these so treated recovered; 19 later had the large tube removed and were treated by the closed method to be described later. About November 8, 1918, through the courtesy of Lieut.-

Col. Joseph Miller, formerly commanding officer of this base hospital, later of the Surgeon-General's office, we learned of the method for treating empyema which was developed by Captain Mozingo, M. C., U. S. Army, at the Walter Reed Hospital, and this method was used on 23 cases.

The essential points in this treatment are:

(*a*) A single operation under local anesthesia, without danger of shock or collapse of the lung.

(*b*) The intermittent removal of pus and antiseptic treatment given through a small tube with a hand syringe.

(*c*) Rapid partial sterilization with Dakin's solution followed later by complete sterilization with 2 per cent. formalin-glycerin solution.

(*d*) Maintenance of negative pressure in the empyema cavity tending to early obliteration of the cavity.

(*e*) One dressing which will last several days, with no skin irritation.

Our technic, carrying out the above essential points and differing in a few details from the original method, was as follows: Under novocain or nitrous oxide a 7 mm. trocar with cannula was introduced into the pleural cavity, a small incision in the skin having been previously made over the cavity, which had been determined by the preliminary aspiration. The trocar was withdrawn, leaving the cannula in place, and a 24 F. catheter, with two lateral and one terminal opening, was introduced quickly into the cavity, care being exercised to prevent the entrance of air. The cannula was then withdrawn, leaving the tube fitting snugly in the opening through the chest wall and a hemostat clamped on the tube. Dressings were applied around the tube and these usually did not need to be changed for a week at least, since there was no soiling about the wound. With a 30 c.c. Luer type syringe pus was withdrawn, the tube remaining clamped when the syringe was disconnected, so that no air might enter the chest. The pus was withdrawn in this manner, then 20 c.c. to 50 c.c. of Dakin's solution were injected and sucked out and in several times, in order to churn up and dissolve the pus and fibrinous masses, this process being repeated until the Dakin solution remained practically clear. That Dakin solution does dissolve the fibrinous masses had been experimentally proved.

The cavity was then nearly filled with Dakin's solution and allowed to remain thirty minutes, when it was withdrawn. The treatment was repeated from four to six times in twenty-four hours, the tube being clamped except when aspirating or injecting. When the pus on smear was free from microörganisms the treatment period was extended to twelve hours, and then after each irrigation 30 c.c. to 50 c.c. of 2 per cent. formalin-glycerin were introduced and

remained until the next treatment. When the discharge became sterile to culture and the cavity had diminished to a capacity of 15 c.c. to 30 c.c., the tube was withdrawn and the opening was allowed to heal. An individual syringe and dressing outfit should be used for each patient. If a patient is expectorating pus, caution should be employed in the first irrigation with Dakin's solution, since there may be a bronchial fistula, as has happened in several of our cases that had been operated late after repeated aspirations, in whom an extremely violent paroxysm of coughing evidently was produced by Dakin's solution entering the lung. Subsequent irrigations should be done with normal salt solution or weak Dakin's solution for several days, when the fistulæ usually close, then full strength Dakin's solution can again be used.

Bedside roentgen-ray pictures were repeatedly and systematically taken of all cases, and they proved that negative pressure was maintained and that lung expansion did persist in the cases treated by the closed method; a rapid diminution in the size of the cavity in the cases which had a pneumothorax at the beginning of this treatment was also demonstrated.

Of the 43 cases treated 11 are shown by roentgen-ray plates to be apparently cured of the empyema and have left the empyema ward; 26 are still being treated and at the present time have very low bacterial counts, two to five to the field, with small cavities. The average time between the operation and the closing of the wound was thirty-one days, the shortest time was sixteen days. In discussing the results of treatment it should be mentioned that 37 of these cases had previously repeated aspirations or thoracotomies, and it is not to be expected that the results with this series would be as good as in a series in which the closed method had been used exclusively and instituted early, even before the stage of thickened pus. With the trocar and catheter method the absence of pain so frequently complained of when rib resection was done; the comfort of the patient by reason of clean dressings and ability to move about unhampered by drainage apparatus were apparent. None of the cases treated by this method exclusively developed a pneumothorax, which suggests it as the only method by which a bilateral empyema can be treated. Our experience, we believe, justifies the opinion that the closed method thus described distinctly shortens the course of empyema, since it maintains constant negative pressure in the pleural cavity, prevents the collapse of the lung, promotes early adhesions between the lung and pleural cavity and prevents the secondary infections which are so common after thoracotomies. The simplicity of the technic, the minor character of the operation, the cleanliness and comfort of the patient and the economy of time and of dressings further recommend it as the ideal treatment of empyema so far devised.

The appended table represents the results of our treatment:

	Number of cases.	Drained through bronchus.	Subsequent thoracotomy.	Subsequent closed method.	Convalescent.	Still under treatment.	Deaths.	Mortality, per cent.
(*a*) Aspirations only	35	8	0	0	11	3	21	60
(*b*) Aspiration and 2 per ct. formalin-glycerin	43	4	27	21	8	18	17	42
(*c*) Aspiration with later Brewer tube	25	3	0	17	7	12	6	24
(*d*) Aspiration with Wilson tube	4	0	0	3	1	3	0	0
(*e*) Aspiration with later closed method (Mozingo)	19	2	0	19	6	11	2	10
(*f*) Closed method exclusively (Mozingo)	4	1	0	4	1	4	0	0
(*g*) Total of (*e*) and (*f*)	23	3	0	23	7	15	2	8
(*h*) Total treated by closed (Mozingo) method after aspiration or aspiration and one of the other methods of thoracotomy	43	0	0	0	11	30	2	4.6

By way of explanation it should be noted that most all of the entire series of 105 treated cases had a combination of treatments, and the above table should be interpreted with this in mind.

REVIEWS

A Text-book of Practical Therapeutics. By Hobart Amory Hare, M.D., Professor of Therapeutics, Materia Medica and Physical Diagnosis in the Jefferson Medical College, Philadelphia. Seventeenth edition. Pp. 1023; 145 engravings and 6 plates. Philadelphia and New York: Lea & Febiger.

A work of this character, and one which has undergone seventeen editions, with a thorough revision upon each occasion, hardly needs any words of introduction to the medical profession. The book has been prepared with the utmost care and the greater portion entirely rewritten. Throughout the author has cited many of the most recent investigations, and in all instances he gives the reader the benefit of his good judgment, founded upon many years of keen observation and actual bedside results. He has endeavored to sift out the practical facts pertaining to all literature on this subject.

The book is arranged into four parts, each part dealing with a distinct portion of therapeutics. In Part I, Dr. Hare treats of the general therapeutical considerations, in which he points out the urgent need of early diagnosis prior to the resorting to the different remedies. Definitions, modes of action, absorption, ways of administration and general considerations about the patient are given. Part II is entirely given over to drugs, giving their source, physiological action, toxic effects, official preparations and conditions in which they are best used. To this chapter many new drugs, as well as new official names of old drugs, such as arsphenamin, barbital, barbital sodium, procain, etc., have been added. The reader is also urged to use these names and products, as they are now produced in this country and not, as formerly, in Germany. In Part III new methods of treatment have been added. These have been brought out since the beginning of the war, and include the use and preparation of Dakin's solution, Dichloramin-T and chloracosane. They are described in sufficient detail to allow a good working basis and reference for the busy practitioner and student. Lee and Furness's paraffin treatment of burns is also described. In the article upon the treatment of cerebrospinal meningitis; the author's ideas do not coincide with the latest researches upon this disease. Most investigators now look upon this infection as primarily a bacteremia and in such conditions urge early intravenous injections of from 50 to 100 c.c. of the antimeningococcic serum, this dose, in turn,

being repeated as often as the infection requires. This, of course, is carried on in addition to the spinal drainage and the intraspinal serum administration.

In Part IV the author sets forth many of the most modern ideas of treatment. The treatment of diabetes is entirely rewritten and all modern conceptions of the disease have been introduced. The management of the case is given in detail, with such criticisms as have been gained by the treatment of many such cases. As a whole, it is the best quick reference-book on the subject of therapeutics that one can secure. T. K.

ELEMENTARY BACTERIOLOGY AND PROTOZOÖLOGY. FOR THE USE OF NURSES. By HERBERT FOX, M.D., Director of the William Pepper Laboratory of Clinical Medicine in the University of Pennsylvania. Third edition. Pp. 222; 68 engravings and 6 colored plates. Philadelphia and New York: Lea & Febiger, 1919.

THE reviewer regards this book the best of its kind for the instruction of nurses; the author has chosen the subject-matter with much care and presents it in a clear, forcible and logical manner, with just enough detail to enable nurses and laymen to obtain a good, general grasp of the elements of bacteriology, particularly from the standpoints of etiology and prevention of disease. The illustrations, and especially the colored work, are good and aid the student nurse to grasp and understand her laboratory work, which should always be given in addition to a lecture course. J. A. K.

HUMAN INFECTION CARRIERS. By CHARLES E. SIMON, Professor of Clinical Pathology in the Maryland School of Medicine and the College of Physicians and Surgeons, Baltimore, Maryland. Pp. 250. Philadelphia and New York: Lea & Febiger, 1919.

THIS rather unique volume is presented to the medical public, to use the words of the author, "As the outcome of the renewed interest which the subject of infection carriers has acquired since the outbreak of the Great War and the resulting necessity of guarding the health of our troops against epidemics." Now that the soldier is returning to civil life it behooves all of us to be on the alert for the carrier, and in this book of Dr. Simon's we have the latest presentation of the subject.

Asiatic cholera, diphtheria, plague, typhoid fever, paratyphoid fever, epidemic cerebrospinal meningitis, bacillary dysentery, acute

poliomyelitis, pneumococcus pneumonia, streptococcus infections and influenza are the diseases considered from the standpoint of their spread by carriers. Each disease is thoroughly covered. Active and passive carriers are discussed; the modes of infection pointed out; the method of recognition of carriers clearly shown; the treatment and management of carriers outlined. An excellent bibliography accompanies each chapter. Altogether, the work is complete and satisfactory, and well worth careful reading.

A. G. M.

A Treatise on Orthopedic Surgery. By Royal Whitman, M.D., M.R.C.S., Eng., F.A.C.S., Associate Surgeon to the Hospital for Ruptured and Crippled. Sixth edition. Pp. 914; 767 illustrations. Philadelphia and New York: Lea & Febiger, 1919.

The present edition of this book shows a few changes of minor importance in the larger part of the volume, but the chapter on military orthopedics has been extensively revised and contains almost fifty more pages and many more illustrations than it did in the previous edition. On account of the war, orthopedic surgery has assumed more importance than ever before, and it is but natural that there should be a great demand for good text-books on this subject. The volume under consideration seems to fill such a need, as it is complete without being bulky, and the fact that it is now in its sixth edition is evidence of its acceptance by the profession.

The section on military orthopedics contains the rules of the selective service governing orthopedic disabilities, showing conditions which may be unconditionally accepted for service and those which must be rejected, and it is interesting to note how this branch of surgery has been able to classify these conditions with accuracy from the functional standpoint. The treatment of fractures in military service is outlined and a lengthy description is given of the Thomas splint, which was of such great value to the allied armies. Bone-grafts, artificial limbs and kineoplastic amputations are all considered, though not extensively described, while nerve injuries and reparative surgery of the nerves are briefly included.

The war being over, the question might be asked relative to the value of all this knowledge in the pursuit of civil surgery, but a moment's consideration will reveal the enormous advantage that will accrue to industrial surgery in peace times as a result of these advances that have primarily been due to the necessities of war. To the orthopedic surgeon this book will need no introduction, while the general practitioner or student will find in this volume all that could be expected of a standard text-book on orthopedics.

F. B. B.

THE OPERATIONS OF OBSTETRICS, EMBRACING THE SURGICAL PROCEDURES AND MANAGEMENT OF THE MORE SERIOUS COMPLICATIONS. By FREDERICK ELMER LEAVITT, M.D., Formerly Assistant Professor of Obstetrics and Gynecology, University of Minnesota. Pp. 466; 248 illustrations. St. Louis: C. V. Mosby Company, 1919.

THIS book deals with obstetrics from the operator's viewpoint and embraces all the obstetric complications that will be encountered and considers the operative procedures at our disposal in the treatment of such accidents. There is no consideration given to normal obstetrical phenomena, such as the physiology and mechanism of labor, which naturally do not fall within the scope of this work. In addition to outlining the technic of the various operative procedures, the dangers incident to the performance of each particular operation are mentioned and the best means to avoid these dangers is described. This is a particularly useful and usually neglected feature in text-books, inasmuch as the average book tends to make the inexperienced reader believe that the operative procedures are as easy to perform as they appear in the illustrations.

There is little in the way of critical comment that a reviewer can offer, inasmuch as the book follows the usual lines of text-book construction. It is well printed and amply illustrated, and with one or two exceptions the statements made by the author are accepted by the profession. The question arises, however, as to whether there is a need for a book of this kind, as all the material contained therein may be found in the more recent standard text-books of obstetrics and, on the other hand, this book is too large to be looked upon as a convenient and compact volume to be carried about by the practitioner in the performance of his obstetric practice to be used as a quick reference. F. B. B.

UNITED STATES ARMY X-RAY MANUAL. AUTHORIZED BY THE SURGEON-GENERAL OF THE ARMY. Prepared under the Direction of the Division of Roentgenology. Pp. 506; 219 illustrations. New York: Paul B. Hoeber.

THIS book was prepared to serve as a guide to roentgenologists doing work in the military hospitals during the war and as a text-book for instruction in the schools of military roentgenology. It was written by a number of well-known experienced roentgenologists, and is, therefore, authoritative. Experience has proved that it has served its purpose well as a text-book for the beginner and as a means of familiarizing the skilled roentgenologist with physics and apparatus. It is a book which every roentgenologist should possess

and with which he should be familiar, and can be recommended as probably one of the best text-books published so far for use in medical schools. The section on physics was prepared by a well-known physicist who has devoted much time to investigations in connection with the roentgen rays and who has had much to do with developing roentgenology in the army. The section on localization describes in detail the most efficient methods as adopted by the division of roentgenology after a careful study of all methods in use by the allied nations before this country entered the war, with many important improvements added. The section on apparatus describes the appliances devised for military use. Needless to say, these are truly American, and of which we can justly feel proud. The remainder of the book is given up to the essential points of diagnosis, and the subject is presented in a concise and at the same time comprehensive manner.

H. K. P.

ROENTGENOTHERAPY. By ALBERT FRANKLIN TYLER, B.Sc., M.D., Professor of Clinical Roentgenology in John a Creighton Medical College; Roentgenologist to St. Joseph's, Bishop Clarkson Memorial, Ford, Immanuel, Douglas County and Lord Lister Hospitals, Omaha, Neb., etc. Pp. 162; 111 illustrations. St. Louis: C. V. Mosby Co.

THIS little book is intended as a text-book in simple terms for the student in roentgenology to teach him the principles of roentgen treatment. In this way it would seem to serve its purpose in an admirable manner. The only criticism of the book is that the author has not gone more deeply into the subject. The book can be recommended outside the pale of roentgenology as a handy reference for the applications and possibilities of roentgen therapy. The armamentarium necessary for the work is briefly explained, the special applications for roentgen treatment and the technic described and numerous representative cases of various conditions cited.

H. K. P.

THE SCIENCE AND ART OF DEEP BREATHING AS A PROPHYLACTIC AND THE THERAPEUTIC AGENT IN CONSUMPTION. By DR. SHOZABURO OTABE, Assistant Medical Officer, Kensington Infirmary, London. Pp. 113. New York: William Wood & Company, 1919.

IN this little volume the author cites himself as an example of the modern way of living which has long been in vogue in the Western Hemisphere, but not in the Orient. In a terse and concise

manner he describes how he became a strong and healthy man after being affected with osteomyelitis as a child. The entire process he ascribes to his deep-breathing exercises, taken several hours during the day. He prescribes these exercises in moderation in the beginning, with a gradual increase, until the patient continues his deep breathing for a period of four or five hours each day. In this way, he points out, full expansion of the apices of the lungs is obtained, causing a greater blood supply and better drainage. In this way the author feels that he prevents the development of pulmonary tuberculosis. These findings are also based upon limited animal experiments. However, the author leads his readers to believe that a positive blood culture is easily obtained in these cases. This finding is not in accord with other investigators. Cornet's experiments of breathing air containing an attenuated virus of tubercle bacilli without producing primary lung lesions, but a tracheoglandular disease, should not be forgotten in this connection, and the direct benefit derived is by an increased metabolism and resistance of the entire body and not the lungs alone. The book is written in an interesting manner, and will be of benefit to the general public as well as to the physician. T.K.

RESEARCHES ON THE PATHOLOGY OF MUSTARD-GAS (DICHLORETHYLSULPHIDE) POISONING. UNIVERSITY OF MICHIGAN CONTRIBUTIONS FROM THE PATHOLOGICAL LABORATORY. By ALDRED SCOTT WARTHIN, PH.D., M.D., and CARL VERNON WELLER, M.S., M.D. Vol. IX, 1918–1919. Ann Arbor, Mich.

THIS volume is composed of six reprints of papers published by the authors, in conjunction with Herrmann and Roos, on the pathology of the acute lesions of the skin, ocular, respiratory and gastrointestinal tracts produced by mustard gas; also the general pathology, clinical pathology and treatment of mustard-gas poisoning and injuries and a bibliography of twenty-seven references to the domestic and foreign literature on this subject. Most of the work on the pathology of mustard-gas poisoning was conducted with experimental animals, while the reports on the clinical pathology and treatment are largely based upon work among gassed soldiers. That the subject is one of great interest and importance is well known, and the authors are to be congratulated for an excellent, comprehensive and well-executed research elucidating the manifold lesions produced by this dreadful substance. The results are clearly and briefly presented and the text greatly aided by a series of splendid photomicrographs. Inasmuch as the ultimate effects of gas-poisoning are of primary importance now during the period of reconstruction, it is hoped that the authors will contribute further on the subject in reference to the chronic and healed lesions. J. A. K.

SURGICAL ASPECTS OF TYPHOID AND PARATYPHOID FEVERS. By A. E. WEBB-JOHNSON, D.S.O., M.B., PH.B., F.R.C.S., Consulting Surgeon, B.E.F., Hunterian Professor of Surgery and Assistant Surgeon to the Middlesex Hospital. Pp. 190, 28 illustrations, including 2 plates. London: Henry Frowde and Hodder & Stoughton, 1919.

COLONEL Webb-Johnson has presented not only an exceedingly interesting book historically, but one of great value to the surgeon. He had many opportunities for closely observing a large series of cases in this group of diseases during the present war, and he has utilized these opportunities to the best possible advantage. The "carrier" problem, one of extreme interest to the civilian community as well as to the Army is ably set forth. The role played by the spleen is also fully discussed.

This work is very acceptable to the medical profession at this time, for until the Hunterian Lecture delivered by the author in 1917 but scant literature was brought out on the subject since 1898, when W. W. Keen published his contribution to the subject.

The book makes most pleasing, instructive and entertaining reading. The subject-matter is well covered, and the book itself does great credit to the author as well as the publishers.

E. L. E.

AIDS TO SURGERY. By JOSEPH CUMMING, M.B., B.S., F.R.C.S., ENG., Surgeon to the Royal Free Hospital; Late Surgeon to the Cancer Hospital; Late Surgeon to the Victoria Hospital for Children, etc., and CECIL A. JOEL, M.S., LOND., F.R.C.S., Assistant Surgeon to the Royal Free Hospital. Fourth edition. Pp. 420. New York: William Wood & Co., 1919.

THE fact that this work has gone into the fourth edition is evidence that it is good. In this the last edition an endeavor has been made to incorporate all the latest advances in military surgery. This, however, has not been entirely accomplished, but a great deal of useful military surgery has been presented to the reader.

The book is one of the Student Series, and as such is a very admirable work. It is in no way meant as an exhaustive treatise on surgery, yet it is astonishingly comprehensive. It is written in a style that reads easily, and the subject-matter is arranged, grouped and subheaded in a manner to aid the student in grasping the subject-matter the most readily.

In a book of this size it is to be expected that much will be merely touched upon, but there is surprisingly little of this. All the non-essentials are left for the larger works; only the surgical meat is incorporated.

The work should be a popular one with students. E. L. E.

TRANSACTIONS OF THE AMERICAN SURGICAL ASSOCIATION. Edited by JOHN F. BINNIE, M.D., Recorder of the Association. Vol. XXXVI. Pp. 602. Philadelphia: William J. Dornan, Publisher.

THIS volume deals with many of the much-mooted questions of today, questions which have arisen from our experiences in the recent war. The surgical treatment of war wounds in general is given by C. L. Gibson, M.D., in an able article. Willis F. Manges outlines the methods of foreign-body localization. E. K. Dunham in his article on empyema brings out the great value of the Carrel-Dakin treatment. Georges Dehelly discusses the surgical closure of wounds. Reconstructive Surgery of the Head, Peripheral Nerve Repair, Transfusion, Laminectomy, the Report of the Committee on Fractures and thirty to thirty-five other articles of equal importance and interest are included in this compilation of excellent authors. Every article included is a good one and teaches the reader much that he has longed to know. This is especially true of the contributions on military hospitals and war surgery.

The reviewer can truthfully say that not in a long time has he had the opportunity of reading any work on surgery that can compare to this volume in the sustained interest created.

E. L. E.

LENZMANN'S MANUAL OF EMERGENCIES, MEDICAL, SURGICAL AND OBSTETRICAL, THEIR PATHOLOGY, DIAGNOSIS AND TREATMENT. By J. SNOWMA, M.D., M.R.C.P. London. Pp. 345. William Wood & Company, 1919.

THIS manual is based upon the English edition of Lenzmann's *Emergencies*, which appeared in 1914. It deals with the diagnosis, pathology and treatment of dangerous emergencies of sudden origin which threaten life, such as the emergencies of sudden origin in disease of the respiratory system; in disease of the heart; of the nervous system; of the gastro-intestinal tract; of the urinary organs; emergencies due to acute poisoning and obstetrical emergencies.

Without question the information given is of great value to all practitioners who are called upon to meet emergencies, and the book is thoroughly up to date and easy of reference. This last fact is what makes the book of particular value, inasmuch as in emergencies quick reference is essential. Needless to say, no medical subject can be treated exhaustively in this manner, but this the author does not pretend to do, and, on the other hand, he is to be commended on the practical value of all the chapters he has incorporated in this book.

C. N. S.

LICE AND THEIR MENACE TO MAN. By LIEUT. LLOYD, R.A.M.T.C. (T.), Chief Entomologist in Northern Rhodesia. With a Chapter on TRENCH FEVER. By MAJOR W. BYAM, R.A.M.C. Pp. 136. London: Henry Frowde, Oxford University Press and Hodder & Stoughton, Warwick Square, E. C., 1919.

ONE of the most urgent sanitary questions of the present and the future is the destruction and prevention of lice. This disgusting creature has been proved without a doubt to be the means of spreading typhus fever, relapsing fever and the so-called trench fever. We are familiar in this country most particularly with the head louse, children and old people being frequent sufferers. But we must not, however, close our eyes to the fact that serious diseases, even in this country, may be transmitted by the body louse. Lieut. Lloyd has written a very complete treatise, giving in minute detail the structure and life-history of the louse, its dissemination and the methods used in the various parts of the world to destroy it. The practices of the army in the fields are carefully described.

Major Byam gives a very interesting chapter on trench fever and the results of experiments carried out by the British Medical Corps.

Lieut. Lloyd, unfortunately, seems to go out of his way in pointing out that certain conclusions, which to his mind are erroneous, are put forth by American investigators. His references to other investigators of other countries is by name. His mention of American investigators is simply that they are American.

The book, however, is well written and covers the subject completely. C. N. S.

CLINICAL MICROSCOPY AND CHEMISTRY. By F. A. MCJUNKIN, M.D., Professor of Pathology in the Marquette University School of Medicine. Pp. 470; illustrated. Philadelphia and London: W. B. Saunders Company, 1919.

AMID the bewildering mass of medical literature a clear-cut treatise on one of the phases of medical science is conspicuous and most welcome to the worker in that particular field. Such is the volume under review. Dr. McJunkin has covered clinical microscopy and chemistry correlating the material of other authors with his own in a manner that is most satisfactory. The descriptions of technic are clear and selection is made of the most practical methods. The book will prove valuable in all laboratories and to students of medicine.

Chapters are devoted to the examination of the blood, microscopically and chemically, Blood stains are covered fully. The chapter on serology includes the technic of the Wassermann test,

the Widal reaction, agglutinating tests, etc. A section is devoted to the sputum, serous fluids and exudates, another to the urine, another to gastric contents and another to feces.

The book closes with a long chapter on histological and autopsy technic, which correlates admirably the normal and pathological tissues with the materials commonly made the subject of clinical microscopic examinations.

The book is easy of reference, and its clearness of style commends it above many other books treating of the same subject.

C. N. S.

DIET IN HEALTH AND DISEASE. By JULIUS FRIEDENWALD, M.D., Professor of Gastro-enterology in the University of Maryland School of Medicine and College of Physicians and Surgeons, Baltimore; and JOHN RUHRÄH, M.D., Professor of Diseases of Children in the University of Maryland and College of Physicians and Surgeons, Baltimore. Fifth edition. Pp. 919. Philadelphia and London: W. B. Saunders Company, 1919.

A NEW edition of this standard work is welcome. In the opening chapters we find a consideration of the chemistry and physiology of digestion. Digestion and absorption of food, the composition of food, food requirements and the method of planning diets are thoroughly and interestingly discussed. In spite of our present imperfect knowledge of the subject more space might have been devoted to the vitamines.

The various classes of food, such as animal, vegetable, fruits and nuts, are described and analyzed and their nutritive value given. That important food, milk, is dealt with at considerable length. Due consideration is given to the salts. The mineral-containing foods are pointed out. Incidentally, in the several pages on alcohol the authors state their opinion that this substance is of undoubted value in medicine and that its use and abuse have been confused.

After chapters on concentration of food, cooking of food, food adulteration, etc., space is devoted to the feeding of infants and children. Much that is good is concentrated in these hundred pages. Other methods of feeding, such as rectal and duodenal, are not forgotten.

Having considered diet in a general way and sufficiently discussed the different foods as to their composition, digestibility and caloric value the question of diet in diseased conditions occupies the large part of the remainder of the book. Especially instructive is the section dealing with diseases in which diet is the primary factor. Later the dietetic management of surgical cases, army and navy rations, prison dietaries and hospital dietaries are dilated upon. There are thirty pages of recipes. Finally, the chemical composition

of American food materials taken from Atwater and Bryant's *Bulletin* and Locke's *Tables* are given.

Altogether, this standard work is a very complete and satisfactory one on diet. Playing, as it does, such an important and necessary part in so many conditions, diet should always be considered in the management of the sick. Indeed, it would not do many of us harm to question the diet of the apparently well, and Friedenwald and Ruhräh's book should act as a tonic to stimulate us in that direction.

A. G. M.

ROENTGEN DIAGNOSIS OF DISEASES OF THE HEAD. By DR. ARTHUR SCHÜLLER, Head of the Clinic for Nervous Diseases, Franz Joseph Ambulatorium, Vienna. Authorized translation by FRED F. STOCKING, M.D., M.R.C., with a foreword by ERNEST SACKS, M.D., Associate Professor of Surgery, Washington University. Approved for publication by the Surgeon-General, U. S. Army. Pp. 305; 97 illustrations. St. Louis: C. V. Mosby Co.

MOST American neurologists and roentgenologists are familiar with Dr. Schüller's book, which made its appearance in Germany a few years ago, before the onset of the recent world conflict. It is not, therefore, a new book, but the English translation has recently been published. The publication of his book placed Schüller in the position of probably the greatest authority on the roentgen diagnosis of anomalies and pathological conditions of the skull and cranial contents. The work is a very important one and most instructive, and the translator is to be highly commended for his efforts to place the text in the English language. It has been done in a most admirable manner. Having been a student under Schüller, he was well fitted for the task. As this is probably the best and most comprehensive monograph extant upon roentgenology of the head, exclusive of the accessory sinuses, teeth, ear and orbit, it hardly needs further recommendation. To those familiar with the subject it is recognized as authoritative, and those who have known Schüller realize that he was a master of his subject. While the book deals particularly with the roentgen aspect, interest in it need not necessarily be confined to the roentgenologist's viewpoint, for it appeals to anyone from the general diagnostic standpoint.

The first chapter deals with the morphology of the normal skull in different races and at different ages. The second chapter discusses the anomalies in size, shape and contour of the skull, due to disturbances or abnormalities in skeletal development and growth. This subject is dealt with in a very thorough and comprehensive manner, based upon an unusually wide experience. This chapter also deals with changes in consequence of systemic diseases—cretinism, achondroplasia, Paget's disease, rickets and many rare

affections—and also conditions of inflammatory origin and tumors of the bones. Injuries do not receive as much attention as would be expected at this present time. The third chapter includes pathological conditions within the skull that can be demonstrated directly by the roentgenogram or indirectly through pressure, bone destruction, bone formation or secondary invasion of the accessory sinuses. A very thorough discussion is given to changes in the sella turcica from various causes. The appendix includes brief remarks relative to various conditions that may be determined in the accessory sinuses, teeth, ear and orbit. H. K. P.

SURGICAL CLINICS OF CHICAGO. By NUMEROUS AUTHORS. Vol. III, No. 3. Pp. 243; 63 illustrations. Philadelphia and London: W. B. Saunders Company, April, 1919.

THIS number maintains the reputation of this important publication, which deserves its continued popularity. The subjects are so numerous and varied that it becomes impossible to even outline the contents of the volume. Andrews briefly but clearly elucidates his method of ligating and dividing the cystic duct in a cholecystectomy, after which he closed the abdominal wound without drainage. He also refers to four cases in which the use of the Parham-Martin band was probably responsible for non-union of fractures. Ochsner writes on the operative treatment of some fractures and on hare-lip, to which Brophy also devotes his attention. Davis offers an interesting modification or addition to the operation of capsulorrhaphy for recurrent dislocation of the patella. Thus throughout the number is crowded with brief and interesting reports of surgical cases by renowned surgeons, with many illustrations. T. T. T.

PROGRESS
OF
MEDICAL SCIENCE

SURGERY

UNDER THE CHARGE OF

T. TURNER THOMAS, M.D.,

ASSOCIATE PROFESSOR OF APPLIED ANATOMY AND ASSOCIATE IN SURGERY IN THE UNIVERSITY OF PENNSYLVANIA; SURGEON TO THE PHILADELPHIA GENERAL, ST. AGNES AND NORTHEASTERN HOSPITALS.

The "Provocative" Wassermann Test.—POLLITZER and SPIEGEL (*Am. Jour. Syph.*, April, 1919, iii, 252) say that no one who has had a large experience with the Wassermann test would deny its great value for the clinician; but no one with any considerable experience would be willing to accept a single Wassermann report, in the absence of supporting clinical data, as conclusive evidence either for or against the presence of syphilitic infection. One of them can point to at least a score of cases of untreated syphilis with florid eruption in the secondary stage in which a laboratory reported the reaction negative; and this not from one laboratory, the quality of whose work would thereby be greatly impugned, but from many laboratories in different parts of the country. They concluded that the Wassermann test is so subject to errors of various kinds that dependence on a single reaction in a series of tests is not justified. In an uncured case a change from a negative to a positive reaction may happen to coincide with the "provocative" injection and a positive found after the injection may be the result of the normal increase in reagent without relation to the injection. In a series of about 150 cases of untreated syphilis of all kinds the writers did not find a single clear case of a provoked reaction, while the assumption of a cure in all cases is obviously untenable. In a series of cases temporarily negative selected as probably not cured, the "provocative" test failed to indicate the presence of syphilis, though the subsequent course of the cases proved that the syphilis was not cured. They regard the "provocative" arsphenamin injection as a useless and often misleading procedure.

A Survey of Wassermann Reactions Made in the Serological Laboratory of the City of Cleveland.—ECKER (*Am. Jour. Syph.*, April, 1919, iii, 260) says that of 9412 Wassermann tests made at the serological laboratory of the city of Cleveland, Ohio, during the last two years,

6475 were male cases and 2937 female cases. The percentage of positives among the males was 23.71 and among the females 24.99. The percentage of positives increased with advancing years, but decreased between the ages of forty-one and sixty. The percentage of positives among females between the ages of sixteen and twenty-five was considerably higher than that of the males of the same ages. The largest number of tests were made among the laboring classes of the city. With the exception of clerks and salesmen there was a larger percentage of positives among the married than among the single in the different occupations. The percentage of positives among housewives was 29.11. The incidence was considerably higher among the colored than the white race. The percentage of positives among the married colored was 46.89, while among the married white it was 27.48. The percentage of positives among the single whites was 25.21 and among the single colored 37.09.

Resuscitation Work in a Casualty Clearing Station.—CHARLES and SLADDEN (*British Med. Jour.*, April 5, 1919, p. 402) say the general lines of resuscitation treatment were followed: Warmth applied by hot air from a paraffin stove, ventilating over the patient into his blankets, and from hot-water bottles, was the first and most important element. To quench thirst by water a sweetened lemonade and other mild drinks were insistent needs and useful aids; it was necessary to prevent excess of drinking in many cases of shock and abdominal wounds in which vomiting was persistent. Morphin judiciously given, heroin in chest cases and camphor as a cardiac stimulant were all utilized when desirable. So far as possible morphin was not given in doses larger than $\frac{1}{4}$ grain nor more than once in twelve hours—exceptions to this general rule seldom had to be made. Intravenous injections were largely used in the worst cases. As a rule, blood transfusion was reserved for the postoperative stage when all bleeding points had been secured. Two methods were utilized: (1) The whole blood method, using the Vincent tube, with paraffined surface; and (2) a very simple citrate method—the latter more commonly. The citrate method was as follows: The blood was drawn from the donor by short curved glass cannula or alternatively by a wide hollow needle, and the flow directed into a sterile graduated measure containing 5 per cent. citrate solution in the proportion of 2 ounces for a pint of blood, 1 to 10. This gives finally a citrate percentage of just under 0.5 per cent., which was found to give a safe but not excessive margin against clotting. It is essential to ensure adequate admixture of citrate with blood either by stirring or agitation of the contents of the vessel. It was found convenient to stock this citrate solution ready autoclaved in 2-ounce (60 c.c.) quantities ready for use. If a hollow needle be used the internal diameter should be from 2 to 2.5 mm. and the length about 4 cm., and it is absolutely essential to have the needle very carefully and recently sharpened. On incision through the skin this is an advantage before inserting the needle. Should there be any doubt of the sharpness of the needle, or if the donor's vein is not well swollen, time is saved by exposing the vein and inserting the glass cannula; it was not found necessary to line either cannula or needle with paraffin. Care is necessary in adjusting pressure to donor's upper

arm, sufficiently but not too strongly, so that a brisk stream of blood is ensured. The citrated blood, kept warm at 40° C., was then run into the recipient's vein by means of a simple funnel, tube and glass cannula as used for saline infusions. The writers conclude that resuscitation methods such as have been developed during the war are of the utmost value in war surgery. It is evident that these methods will be equally applicable in the every-day surgery of accidental injuries and in obstetrics. Gum infusion is an advance on the infusion of normal saline and may enable a patient who has not lost blood excessively to be operated on successfully. It is not evident that the benefit due to gum can extend over more than a few hours. When hemorrhage is severe, blood transfusion is the only reliable treatment and should be given without delay. In such cases it is much superior to gum. In blood transfusion they found no great difference between whole blood and citrated blood. Previous to transfusion a blood-grouping test should be made in every case. If possible the donor should be of the same group as the recipient. They emphasize the need for the strictest surgical aseptic technic toward donor and recipient. The donor must be free from known general infections, such as syphilis or malaria, in so far as can be determined by inquiry.

Operative Treatment of Undescended or Maldescended Testis, with Special Reference to End-results.—COLEY (*Surg., Gynec. and Obst.*, 1919, xxviii, 452) says that in most cases the etiology points to a congenital origin, often influenced by the element of heredity and frequently associated, particularly in the double variety, with other developmental defects. The atrophy usually found in the undescended or maldescended testis is not the result of the malposition. The change in structure and the atrophy are merely coincident, being due to congenital causes. The question of the functional value of the undescended testis cannot be definitely answered in an individual case. It may be stated, however, as a general rule, that an undescended or maldescended testis, with which there is associated a marked atrophy, has little or no functional value. However, the author believes with Uffreduzzi that in a considerable number of cases of undescended testis spermatogenesis is retained. The ectopic testicle is practically always associated with an open vaginal process of peritoneum, *i. e.*, there is usually present a potential hernia. This vaginal process is almost invariably a congenital affair, for the reason that its position is entirely independent of the location of the testis. Torsion of the cord is more frequently observed in the undescended testis than in the normal testis. The undescended testis shows a greater tendency than the normal testis to malignant degeneration. Operation should be advocated in children and in adults. It is possible to cure the hernia in practically all cases, although the testis does not remain at the bottom of the scrotum several years after operation. The atrophied testicle is generally found to have retracted to midscrotum or in the region of the external ring, and in a position somewhat less liable to trauma than before operation. In none of the series of cases operated on at the Hospital for Ruptured and Crippled Children during the past twenty-nine years has malignant disease been known to develop as the result of the trauma incident to the operation. The author still believes

that the undescended testis should never be sacrificed in children and that the general tendency to remove the testis is greatly to be deprecated. Even if the testis be of little functional value it nevertheless is of great value in developing the male characteristics of the child. In adults it has an influence on the mentality and has a moral effect. Operation in the child should be postponed until he is ten to twelve years of age.

Continued Extension by Means of a New Extension Frame in the Bloodless Reduction of Congenital Dislocation of the Hip.—CHURCHMAN (*Surg., Gynec. and Obst.*, 1919, xxviii, 518) says that his method consists briefly in: Application of extension in the line of the legs as they rest in their deformed position; gradual abduction until the legs form with each other an angle of 180 degrees; when maximum abduction has been obtained, digital manipulation of the head of the femur, to drop them into place; maintenance throughout of rotation necessary to keep the toes pointing directly upward; gradual reduction of the maximum abduction until the legs form with each other an angle of about 35 degrees. Application of plaster cast from the waist to the knees; transmission of the body weight to the acetabula, through the heads of the femurs, by allowing the child to walk. If a favorable case in a young infant with well-developed acetabula is treated in this way, not only will the case be simplified by eliminating the violent manipulations hitherto used, but more accurate results will probably be obtained, because it will be found that the head can in this way be at will placed exactly where one wishes it to lie, and that if the position, by roentgenographs, is shown to be not entirely satisfactory, a change in the direction of the extension or rotation straps will make the desired correction.

THERAPEUTICS

UNDER THE CHARGE OF

SAMUEL W. LAMBERT, M.D.,

NEW YORK,

AND

CHARLES C. LEIB, M.D.,

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A Note on Sodium Morrhuate in Tuberculosis.—By a process similar to that by which sodium gynocardate is obtained from chaulmoogra oil, ROGERS (*British Med. Jour.*, February 8, 1919, p. 147) made a preparation of the sodium salts of the unsaturated fatty acids of cod-liver oil which he terms "sodium morrhuate." It is used in the form of a sterile 3 per cent. aqueous solution, administered subcutaneously in gradually increasing doses two or three times a week. When the dose reaches an inconvenient size (2 c.c.) it is given by intravenous injection. Sodium morrhuate has been under trial for a year by the

writer and four other observers. From their observations, the author draws the following conclusions: In the doses recommended, sodium morrhuate is harmless in tuberculosis; at the same time, the fact that it causes febrile and local reactions necessitates caution in its use. Improvement in phthisical cases is seen in reduction and cessation of the fever, diminution of the expectoration and cough, and steady gain in weight, the last being a very marked feature. In addition, the tubercle bacilli in the sputum greatly decrease in number and may in time disappear. Moreover, they commonly show deficient acid staining and a granular appearance, indicating that they are actually being destroyed within the tissues. The author has also used sodium morrhuate in leprosy and a year's experience has shown it to be of great value in this disease. This supports the writer's view that there is nothing specific in the products of chaulmoogra oil in leprosy and that the sodium salts of the unsaturated fatty acids of the two oils act in some way on the coating of the acid-fast bacteria. As both tuberculosis and leprosy are produced by acid-fast bacilli, sodium gynocardate might be expected to exert a beneficial action in phthisis; however, in rare cases of leprosy, sodium gynocardate intravenously caused prolonged febrile reaction with temporary exacerbation of the disease so the author hesitated to use it in tuberculosis.

Inunction of Creosote in Pneumonia and Influenza.—WELLS (*British Med. Jour.*, April 19, 1919, p. 481) treated his cases of influenza by rest in bed, plenty of fresh air and the administration by mouth of 0.5 minim creosote shaken up with half an ounce of water. Very few cases treated in this way developed pneumonia. When signs of pneumonia appeared the axillary inunction of creosote (10 minims) was nearly always followed by its abortion. A second dose was rarely necessary. The patient was dressed in flannel and placed between blankets to avoid a chill after the sweating. The only disagreeable after-effect is a slight burning of the skin for a day or two. For children the creosote is diluted with soap liniment. Since 1898, the author has made frequent use of this method in pneumonia with almost unvarying success; he considers the results too constant to admit of the change in the patient's condition being merely a coincidence with the crisis occurring at the time of the administration of the treatment. He believes creosote administered by axillary inunction enters the blood stream through the lymphatics and is taken direct to the lung tissues by the pulmonary circulation; its diaphoretic action helps to relieve the hyperemia of the lung tissues and its antiseptic action is brought to bear directly on any germs that may be present in the air spaces of the lungs. When administered by mouth, the action of creosote is mainly that of a local antiseptic and sedative to the fauces, but its action is also felt by the upper air passages.

The Influenza Epidemic of 1918 in the American Expeditionary Forces in France and England.—MACNEAL gives a long and interesting account (*Arch. Int. Med.*, 1919, xxiii, 657) of the influenza epidemic in the A. E. F. in France which broke out in May, 1918. From August, 1918, on, the previously mild epidemic assumed a more malignant character, often leading to a fatal bronchopneumonia. At autopsy the

lungs presented a picture of malignant coalescing bronchopneumonia, frequently with hemorrhagic tracheobronchitis. The changes varied considerably with the chronicity of the disease and the nature of the secondary infections. In fulminant cases influenza bacilli in large numbers were found in the bronchi. The bacillus of Pfeiffer was the apparent cause of the epidemic but at most of the necropsies a mixture of bacteria was found in the respiratory tract. Blood cultures during life were usually negative but pneumococci or streptococci were found in some cases. Overwork, exposure to cold and wet, inadequate nourishment, etc., diminished the natural resistance to the disease and the contagion spread rapidly by distribution in the secretions of the nose and mouth, not only of the sick, but of "carriers" not suffering from the disease. The author considers vaccines of doubtful value; avoidance of contagion and general hygienic measures are advocated. Rest in bed, warmth and bodily comfort, promptly enforced at the onset of the disease, he considers the most important elements in the treatment. The author believes that the epidemic of influenza originated in France from the endemic influenza widely prevalent there and considers it probable that the large numbers of American soldiers in France, subjected to strange environmental conditions, furnished a fertile soil for the propagation of the disease.

PEDIATRICS

UNDER THE CHARGE OF

THOMPSON S. WESCOTT, M.D., AND ALVIN E. SIEGEL, M.D.,

OF PHILADELPHIA.

Influenzal Croup.—REGAN and REGAN (*Am. Jour. Dis. Children*, June, 1919, No. 6, vol. xvii) call attention to the fact that during the past epidemic of influenza a number of cases of "influenzal croup" were seen in their work. The clinical course of the disease, the constant absence of membrane from the tonsils, the failure to respond to antitoxin and the uncertain effects of intubation were all suggestive of an etiology distinct from that of diphtheria. Bacteriological and pathological findings proved this to be the case. At first, however, the clinical resemblance to membranous croup was so close that many of the patients were admitted to the diphtheria wards under an incorrect diagnosis of laryngeal diphtheria. As a rule, the disease begins with the symptoms of influenza, and then after a period of from two to ten days the signs of croup appear. The subsequent course of the malady is similar to that of diphtheritic croup, and depends on the severity of the laryngeal involvement and on the presence or absence of a complicating pneumonia. It was common for the symptoms of laryngeal obstruction to progress to a point of impending asphyxia, during periods of spasm, and at such times there was marked retraction of the suprasternal fossa, of the epigastrium and the disappearance of the radial pulse during inspiration, noisy breathing, cyanosis of the

skin and mucous membrane, profuse sweating and extreme restlessness. In a small percentage of cases the attacks of asphyxiation increase in frequency and severity to such a degree that operative interference is required or death results. More commonly, however, under favorable conditions of treatment, the frequency and severity of the spasms diminish, and after from three to five days they disappear altogether. If a pneumonic complication exists, as is commonly the case, the symptoms of laryngeal stenosis usually dominate the clinical picture, the pneumonia occupying a place of secondary importance. Under such circumstances auscultation of the chest will fail to reveal the presence of a pulmonary consolidation, owing to diminished aëration, but percussion may bring out areas of dulness. Certain symptoms of influenzal croup differ from those found in laryngeal diphtheria. Thus the tonsils and larynx are free of membrane, the mucous membrane of the throat having a deep red, dry, glistening appearance from the moist appearance common in diphtheria. The mucosa of the mouth is parched, and in the early stages of the disease the tongue is dry and feels hot to the touch. Auscultation of the chest reveals the presence of a considerable number of sibilant and sonorous rales. In two instances of the authors' series the disease was complicated by pregnancy. In one case both the mother and the child died and in the other the mother recovered and there was no obvious effect in the child. Influenzal croup was most frequent in children between the ages of three and ten, boys being more often affected than girls. In no instance was there a history of exposure to diphtheria, while in 14 of the 20 cases of this series there was a definite history of exposure to influenza; in most all to some one ill with the disease in the immediate family. Often the connection between the two conditions was extremely striking. Death occurred in 5 of the series. The mortality was rather low, inasmuch as many of the patients presented symptoms of extreme laryngeal stenosis, and all but 3 had pneumonia. The causative agent of this particular form of croup is not the diphtheria bacillus. Cultures taken from the nasopharynx, the tonsils and the sputum during life and from the larynx, trachea and lungs after death all uniformly failed to show the Klebs-Loeffler bacillus. The bacterial flora found were very similar to that noted in general among influenzal cases. Thus, in the nasopharynx culture there was a predominance of the Pfeiffer bacillus, pneumococcus and Micrococcus catarrhalis. In the cultures from the sputum streptopneumococci and Pfeiffer bacillus were most common, with pneumococci and staphylococci in less numbers. In cultures taken postmortem from the larynx and trachea staphylococci were most common. Pfeiffer bacilli and pneumococci in somewhat less numbers. The blood picture varied. Leukopenia occurred, but was very inconstant. A moderate leukocytosis was most constant, as the frequency of pneumonia would lead one to expect. Blood cultures in one instance showed streptococci. Four patients came to necropsy. In 2 of the 4 the gross pathology was very similar. In each of these 2 cases there was an extensive, massive bronchopneumonia in the lower lobes of both lungs, with ecchymotic spots under the pleura, together with a severe grade of edema of the unconsolidated tissues. The larynx was intensely congested, the mucous membrane of the epiglottis swollen and edematous, likewise

the mucosa around the true and the false cords. The congestion and also the edema to a lesser extent extended downward to the trachea and the bronchi. Scattered here and there over the surface of the mucous membrane were a number of minute, whitish plaques, measuring about a half an inch in diameter and easily removed from the mucosa. The spleen appeared large and congested in both cases. In the third case there was some extensive bronchopneumonia, with severe congestion and some edema of the larynx, but without any exudate on the membrane. In a fourth case only the larynx was examined; in this instance the larynx appeared the same as in the last-mentioned necropsy. Microscopic section of the larynx and trachea showed definite pathological changes. The surface epithelium of the mucosa was intact and there was no evidence of film formation, showing its dissimilarity to diphtheritic laryngitis. The bloodvessels of the mucosa and submucosa were markedly dilated, and there was an extensive exudation of polynuclear cells, lymphocytes and serum into the surrounding tissues. The thickening of the mucosa and submucosa was greatly increased by the infiltration of its tissue and the dilatation of its bloodvessels. In the treatment of the malady it was found usually best to administer diphtheria antitoxin, owing to the difficulty of making a definite diagnosis from laryngeal diphtheria. Direct laryngoscopic examination presents many difficulties in patients who are irrational, difficult to control and dyspneic. Then again, cultures required time for examination. The treatment that proved exceedingly effective was the use of steam inhalations, carried out in a small room, in which the saturation of the atmosphere with vapor could be carefully controlled. The results were very satisfactory, and there is little doubt that a number of intubations were thus avoided. In addition to steam inhalations, flaxseed poultices were applied to the neck; morphin sulphate and atropin sulphate were given in doses proportionate to the age, to control the spasms and the restlessness. Intubation was required in 6 patients, one being an adult. The immediate effect of the introduction of the tube in most instances was to make the patient worse, and extubation had to be immediately performed in 3 cases. The harmful effect seemed to be due to the fact that the pressure of the tube increased the congestion existing in the mucous membrane below, further adding to the mechanical obstruction. Antipneumococcic serum was used in one case, with very beneficial effects. It well deserves a trial, especially as the causative agent is often associated with the pneumococcus. This seemed to be the case more commonly in children. In adults the infection is often of a somewhat different type, the streptococcus and the staphylococcus predominating. In the former instance a polyvalent streptococcic serum is suggested as well worth a trial. In cases in which the predominant infection is streptopneumococcic a combined polyvalent serum is recommended. Diphtheria antitoxin seemed to have no effect on the local process.

Fat Metabolism of Infants and Young Children: II.—Holt, Courtenay and Fales (*Am. Jour. Dis. Children*, June, 1919, No. 6, vol. xvii) continue their observations on fat metabolism. In this article are collected the results of analysis of 128 stools of 77 infants, whose

ages ranged from two to eighteen months, fed on modifications of cows' milk. The average fat percentage of the dried weight of normal stools was 36.2. The hard, constipated stools showed no variation from this figure. In the stools not quite normal in appearance the average fat percentage of dried weight was much higher, reaching an average of 40.7 per cent. The soap percentage of total fat was very high in both normal and constipated stools, averaging, respectively, 72.8 and 73.8 per cent. As the stool became less normal in appearance the soap fat diminished rapidly and averaged in the loose stool only 30.6 per cent. of the total fat, in the diarrheal stool 12.4 per cent. and in those of severe diarrhea only 8.8 per cent. of the total fat. The neutral fat was less than 10 per cent. of the total fat in normal and constipated stools. It increased as the soap fat diminished and in diarrheal conditions made up about 60 per cent. of the total fat in the stool. The free fatty acids constituted about 17 per cent. of the total fat of normal and of constipated stools. It was increased somewhat as the stools became less like the normal, and in the diarrheal stools was over 30 per cent. of the total fat in the stool. No definite relation was shown between the daily fat intake and the percentage of fat and the distribution of fat in the stool. The average percentage of fat retained with normal stools was 91.3 per cent. of the intake. The retention was but little lower when the stools were somewhat harder or softer than normal, or were not homogeneous, or contained more or less mucus without being distinctly watery. As the water in the stools increased the percentage of retention dropped markedly, reaching in severe diarrhea 58.4 per cent. of the intake. There was no striking relation between the fat intake and the percentage of the intake retained, except when the intake was abnormally low.

Chorea.—STEVENS (*Am. Med.*, April, 1919) objects to the characterization of this disease as "infectious chorea." He admits that in a limited number of cases death has quickly supervened upon an attack in which choreiform symptoms have been observed, but that these have been of different kinds in different cases, and he says that it cannot be said that any specific organisms of a bacterial nature is characteristic of the various cases. These are not the typical form of chorea. He thinks that this form is probably some undescribed affection or infection, in which the choreiform manifestations are a part of the clinical picture. He objects to the designation of "chorea minor" and "chorea major" because the difference lies only in a difference of severity. As the principal features of chorea, he claims that there always is a disturbance of motility; that it attacks principally children between the ages of five and fifteen, although it may continue for many years or for a lifetime; that the disturbances of motility are spontaneous or of coördination; that these disturbances of motility are most commonly manifested either as movements of the upper extremities or of the head and face. He says that in severe cases the disturbances extend to the trunk and lower extremities and that in sleep the movements are usually quieted. He has developed the following hypothesis in the search for the predisposing cause: "The principal predisposing cause of the typical form of chorea is found in the unsymmetrical development of different parts of the cerebrum and absence

of exact conformity of growth of the cranium, especially at the anterior portion, inducing a slight pressure on the cerebrum at a point or points controlling the movements which are involved in the choreic disturbances."

Pyloric Stenosis in Infancy.—WALL (*Arch. Pediat.*, 1919, xxxvi, 193), in discussing the conflict of opinion as to the production of stenosis of the pylorus, says that it requires rather a vivid imagination to attribute a great, hard pyloric mass of muscle tissue, perhaps the size of an olive, to the effect of any species of gymnastic exercise which may have been indulged in throughout a brief period of three or four weeks. It would seem more plausible to look upon the hypertrophic stenosis as a developmental aberration such as we find in the lingual frenum, or labial frenum, or in the redundant prepuce of the male infant. Undoubtedly the element of spasm comes into play at a certain stage of a preëxistent hypertrophy, not only spasm of the pyloric sphincter, but overaction of the stomach circular fibers as demonstrated by the peristaltic waves. He has been able to discover but one developmental feature which in the intricacies of embryonic growth may have a bearing upon the conditions productive of hyperplasia of the circular muscle at the pylorus—namely, a temporary obturation of the lumen of the duodenum which is apparently a normal stage of evolution in the fetus at a very early period of growth. Well-marked tumors of pyloric hypertrophy have been reported in the newborn as well as in infants born prematurely, which adds emphasis to the view that hypertrophic stenosis is a congenital defect.

The Treatment of Pulmonary Tuberculosis in Children by Artificial Pneumothorax.—STOLKIND (*British Jour. Children's Dis.*, January–March, 1919, Nos. 181–183, vol. xvi) reports seven cases. He says that the ideal case for artificial pneumothorax is one of advanced pulmonary tuberculosis or the so-called second or third stage, with destructive or ulcerative one-sided disease, in which the other lung is, clinically at least, normal. Such typical cases of advanced and progressive pulmonary tuberculosis, in which only one lung is diseased and the other clinically healthy, are rare. In the majority of cases it is found that the other lung is also diseased more or less. In such case pneumothorax treatment is employed if the disease in the other lung is inactive or chronic and quiescent. If extensive chronic lesions in both lungs are found, pneumothorax must be performed in the most diseased lung first. Afterward, if it is necessary and there is considerable improvement, the gas can be allowed to become absorbed or it may be pumped out, and then a pneumothorax can be performed on the other lung. This treatment is also used in cases in which the disease is not much advanced or the first stage of pulmonary tuberculosis, if the process, in spite of proper treatment by other means, advances and especially if it progresses rapidly, or if there are symptoms of toxemia. As there is at present no sure means of stopping hemorrhage, pneumothorax is indicated in cases with recurrent hemoptysis, and if the hemorrhage is severe or cannot be otherwise arrested. The lung from which the bleeding comes should be recognized and completely compressed, for which purpose 2000 to 3000 c.c. of gas are introduced.

Another indication is in cases of acute and progressive pulmonary tuberculosis or acute tuberculous pneumonia or bronchopneumonia. Other indications are pulmonary tuberculosis with effusions—either hemothorax, serous or suppurative pleurisy, spontaneous pneumothorax and sero- or pyopneumothorax. In carcinomatous pleurisy artificial pneumothorax is beneficial in relieving the pain. Pleural adhesions are not a contra-indication, but may prevent the production of a pneumothorax or a complete collapse of the diseased lung. Pneumothorax treatment is contra-indicated in cases of pulmonary tuberculosis complicated by other severe disease, such as diseases of the circulatory system, liver, kidney or severe diabetes and emphysema. No more than 500 c.c. should be introduced at one time and radioscopy should be used as a guide, both as to the extent of the initial introduction and as to the necessity of a refill. In children anesthetics should be used when the treatment is given. The most frequent complications are subcutaneous emphysema and pleural effusions. The emphysema is harmless and disappears in a few days. The pleural effusions may appear at intervals ranging from weeks to months after introducing the gas. It is mostly due to infection which is chiefly tuberculous. The improvement which is often observed in phthisis after the occurrence of pleural effusion is due not only to better rest and immobilization of the compressed lung, but probably also to the serobiological influence of the exudate, which contains many antibodies or hemolytic and bactericidal complements.

Conditions Which Affect the Occurrence of Rectal Diseases in Infancy and Childhood.—Landsman (*Med. Rec.*, 1919, xcv, 1089). To begin with we must not lose sight of the fact that the rectum is in intimate contact with the bones which form the posterior wall of the pelvis; hence, any difference in their shapes must be marked by a corresponding difference in the curves of the rectum. An examination of the infantile sacrum shows it to be relatively flat, shallow and less curved than that of the adult, while the coccyx is soft, yielding and its joints more freely movable. In agreement with this the rectum would acquire a tendency to become more straight in its course and direction, and to that extent to lose the essential support to which the shape of the bones contribute to such a marked degree. In accordance with the principles of mechanics, force applied on an object through a vertical axis produces a greater effect than when exerted through one which is curved. This offers a reasonable explanation of the frequency of prolapse of the bowel in children. Congenital defects are mostly dependent upon failure of the two parts which form the embryological rectum, the caudal extremity of the hind gut derived from the endoderm and the proctoderm derived from the invaginated ectoderm to unite properly. Other defects are due to failure of fusion or absorption connected with the cloaca. When we turn our attention to the problem of the functional activity of the organs as they affect rectal disease in the infant and young child we learn there are conditions which produce varying results at different age periods. Defecation, so far as it applies to infancy and young childhood, is an involuntary act, the resultant of automatic function which proceeds in a normal and orderly manner as long as there is no interruption in the reflex arc which carries

the impulse. Such is not the case in adults in whom the expulsion of intestinal contents is generally postponed to a convenient time. Hemorrhoids are rare in children. Rectal diseases occur with varying frequency in childhood and adult life; their presence or absence is not due to chance, but depends upon well-defined variations in the anatomy of the parts, the functional activity of the organs and the environment of the individual.

OBSTETRICS

UNDER THE CHARGE OF

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Labor Complicated by Uterine Inertia.—TITUS (*Jour. Am. Med. Assn.*, September 14, 1918) draws attention to the difficulty of classifying cases of uterine inertia because the element of time alone is not sufficient to establish a classification. One must take into consideration the type of patient and what would naturally be expected from a person of the particular type. The effort to make a distinction between primary and secondary inertia is of very doubtful value. But there is a difference between inertia and exhaustion. Inertia uteri is often due to inherent fault or lack in the muscle and nerves of the uterus, while exhaustion follows a long continued effort against an obstacle. The prophylactic treatment of the two is evidently different for while little or nothing can be done to prevent uterine inertia such obstacles as face presentation, contracted pelvis or posterior occipit can be recognized and thus exhaustion prevented. Inertia is usually apparent in the first stage of labor. Those who are below par physically from any cause endure the nagging pains of the first stage of labor very poorly. Oftentimes the patient becomes entirely unreasonable, demanding instant relief and exciting great apprehension in the minds of those about her. Even though the membranes be not ruptured a greatly prolonged first stage may lead to exhaustion through lack of sleep and lowering of the power of resistance. When the membranes are ruptured the condition may readily become serious. In 76 cases of inertia of the uterus 21, or 26 per cent., seemed to be due to the fact that the membranes had ruptured before labor pains began. The fact that the membranes ruptured early does not inevitably mean inertia for many patients have strong labor pains and rapid delivery following premature rupture of the membranes. If, however, the membranes have been ruptured for some time it is more than probable that interference will become necessary. A rise of temperature on the part of the mother with increased pulse-rate or rapid, irregular or very slow fetal heart-beat, with or without the passage of meconium, show that the fetus is in danger. Interference may mean incision of the cervix, damaging pressure from forceps, laceration, hemorrhage and liability to infection. If the patient can be carried on into the second stage of labor whether the membranes

be ruptured or not, it is much more feasible to meet the various indications. Repeated vaginal examinations during prolonged labor become a source of especial danger through infection. Some urge that examinations be made by rectum instead of through the vagina. Early delivery by forceps may be advisable even though serious symptoms have not appeared, for it is fair to assume that inertia in the first stage of labor indicates a possible similar condition in the second. Unfortunately, in these cases the patient often becomes so fatigued during the first stage that in the second stage she is unable to bring her abdominal muscles into play. Of the cases observed 21, or 27.6 per cent., followed rupture of the membranes before labor began, while in 3 cases membranes ruptured soon after the beginning of the pains. Inertia occurred in three patients who had been observed in their first delivery and again in their second. The oldest primiparæ were thirty-nine years of age and the youngest nineteen, while the average age in primiparæ was twenty-seven years. The oldest multipara was forty-two, the youngest twenty, the average age in this class was thirty-one years. There was one primiparous woman under twenty; 1 between twenty and thirty and 16 past thirty years of age. There were 7 multipara between twenty and thirty; a total of 58 were primipara; 17 were multiparas while the parity of one is not recorded. Of the multipara 9 were in second labor; 1 in the third; 2 in the fourth; 2 in the sixth; 1 in the seventh; 1 in the eighth and 1 in the eleventh. Among these using morphin-scopolamin inertia was exceedingly common. In the first stage of labor 12 cases required interference, while 41 went into a second stage before it became necessary to give assistance and 23 patients delivered themselves spontaneously, a percentage of 15.7, 53.9 and 30.2 respectively. The longest first stage of labor in the primipara was 174 hours; the shortest seven hours; the average time 38.3 hours, while among multipara the longest stage was 96 hours; the shortest eight and the average 34.3 hours. It is difficult to give exact figures concerning the second stage, and in some cases birth took place so rapidly that there was practically no second stage. The longest was eight and one-half hours in the primipara and four and one-half hours in the multipara. To state that a patient was allowed to continue eight and one-half hours in the second stage may be somewhat surprising, but it must be explained that there was some progress, although slow, throughout this time and no untoward symptoms developed, while at the same time the patient was being sharply watched. When interference developed during the first stage it was multiple incisions of the cervix. Interference during the first stage consisted in multiple incisions in the cervix, followed by forceps delivery in 8 cases. Vaginal Cesarean section once, Braxton-Hicks; version later completed by extraction once; craniotomy on a dead child once and the introduction of a bougie once. Abdominal Cesarean section has not been found necessary and was not considered safe after the patient had been long in labor, especially with ruptured membranes unless the extraperitoneal type of section is employed. Bags were not used although they might have been at times of great value. Forceps were used in the second stage 41 times, and of these patients 16, or 21 per cent., developed postpartum hemorrhage of more or less serious degree. In the first stage interference became necessary six times and twice in the second on

account of exhaustion of the mother, as shown by a rise in the pulse to 110 or more and a temperature of 100.5° or more. Once in the first stage interference was practised on account of mitral stenosis combined with evident distress on the part of the infant. Twice in the first stage and ten times in the second. In the second stage interference was necessary—17 times on account of undue prolongation without progress. Twice because of posterior occipito positions; twice because of heart lesions in the mother. There were no maternal deaths but five infants were born dead, or so deeply asphyxiated that they could not be revived. One of these dead infants was macerated. Two infants died within the first few days of life with the symptoms of intracranial hemorrhage. The inertia was apparently due to premature or early rupture of the membranes in 24 cases; the artificial induction of labor in 2 cases; physical debility from heart lesions in two; syphilis in one and tuberculosis in one; a twin pregnancy was responsible once, while multiparity seemed to be the factor in a few indefinite cases. Four cases had posterior rotation of the occiput in labor. The morbidity in these patients has not been thoroughly worked out, but seven showed a seriously febrile puerperium, although all recovered. In 1 case of this group there had been innumerable examinations by a midwife and in another a physician outside of the hospital had attempted to deliver by forceps. In 1 case the placenta had been removed manually after hemorrhage during the third stage. Puerperal psychosis occurred in two patients with subsequent recovery in both instances. In 6 cases there was retention of the placenta, three of these being due to hour-glass contraction of the uterus. Pituitrin extract given to the second stage produced hour-glass contraction of the uterus. The writer states that he finds very little if any use for pituitrin in his practice. In the first stage of labor it has certainly no place. When given during the second stage the writer has 3 cases of hour-glass contraction with retained placenta as the result of giving pituitrin during the second stage. The best time for its administration is after the expulsion of the placenta when the physician wishes to control the relaxation of the uterus and tendency to hemorrhage. Here it comes into comparison with ergot and it is thought to be much more prompt and efficient than pituitrin extract now given extensively by midwives. The writer insists upon an established distinction between uterine inertia and exhaustion and especially is this valuable in the selection of treatment. True inertia begins in the first stage of labor and with unruptured membranes all that is necessary is mild stimulants alternating with narcotics to produce sleep. If the membranes are ruptured and elevation of temperature or pulse is present any interference must be practised as soon as possible. Frequent vaginal examinations are especially dangerous in these cases and rectal examinations should be substituted in their place. Prompt rupture of the amniotic sac is a common cause of inertia in a patient otherwise well and strong, whereas constitutional defects from distention of the uterus by twins, hydramnios from frequent pregnancies are also important etiologic factors. Retention of the placenta, with or without hour-glass contraction of the uterus, is a common result of inertia extending into the third stage and hemorrhage is likely to occur during and after the placental stage.

Labor Complicated by Rupture and Inversion of the Uterus.—Brandeau (*Jour. arch. mens. de obst. et de gynec.*, 1917, vi, p. 195) records the case of a patient, aged thirty-two years, in her seventh labor. The first five were normal; the sixth a difficult instrumental delivery. At the end of the seventh pregnancy there was a spontaneous rupture of the uterus, after which laparotomy was immediately done. The fetus was among the loops of small intestine and easily extracted. The uterus was inverted and the placenta outside the wound and hysterectomy was performed. On examining the removed uterus it was completely inverted above the tear, so that the internal surface became the external and the peritoneal face was internal. The tubes and round ligaments had penetrated through the rupture and become internal. The rupture was on the left side nearer the posterior than the anterior face. Microscopic examination of the tissues at the tear showed the rent extended through cicatricial tissue in the midst of which were some necrosed muscular fibers. The internal os was also obliterated. The patient made a good recovery. The fact that the patient had a previous difficult labor and probably rupture of the lower segment would account for the rupture occurring in cicatricial tissue. This tissue was only about 1 mm. thick, and the very first beginnings of labor were sufficient to tear it. It is very difficult to account for the practical obliteration of the internal os. The placenta was inserted about 2 cm. above the tear where the uterine wall was exceedingly thin. That portion of the uterus above the tear was inverted and this probably arose from uterine inertia, which was very marked in the case.

The Teaching of Obstetrics. — In the *British Medical Journal*, February 15, 1919, is discussed a discussion which took place at the Royal University of Medicine on the teaching of obstetrics. It has been found impracticable to separate the teaching of obstetrics from that of gynecology. The preventive side of these branches of science was largely in evidence in the teaching. It was proposed to have the teaching hospital unit composed of a complete maternity center, a complete gynecological center and a child's welfare center. Such an arrangement would give the students a comprehensive idea of these allied branches of medicine. It would also be of advantage if the student were left to feel that he had a duty to the community in his work in these various departments. It was proposed by Fairbairn that the care of the infant up to nine months, or a year, belonged properly to the obstetrician. This was denied by some who held that, theoretically, the child should be in charge of the pediatrician from its birth. If this is impracticable the usual custom might prevail of having the infant pass from the care of the obstetrician when the mother had recovered fully from her confinement. It is of the greatest importance that pregnant women should receive thorough care. Even in toxemic conditions if the patient be carried safely through pregnancy there is no good reason to fear that the child may not grow up to be healthy. In proportion as the pregnant woman receives careful attention eclampsia will grow less frequent and such serious operations to secure a successful birth will become more rare. It must still be remembered that such care will not prevent the occurrence of adherent placenta or placenta

previa. It is of the utmost importance that obstetrics be considered a major subject in the medical curriculum. A six months course is the least possible preparation which should be given to this important branch. The students should also have a practical knowledge and they should be taught by senior teachers and not by junior and assistant members of the staff. The idea of whole time teachers is attractive, but the value of this proposal is open to question. To be successful large salaries must be paid. There is also the disadvantage that a whole time teacher might not have experience in private practice. No one can teach obstetrics successfully who is not continually engaged in clinical work among actual patients. The teaching department in obstetrics must also be a center of research. The routine work in such a department should be done by the junior member of the staff. The function of the chief would be to inspire, suggest and guide. In the very important problem in addition to what may be suggested for the improvement of obstetric teaching it must not be forgotten that the better education and control of midwives should receive attention.

The Teaching of Obstetrics and Gynecology to Medical Students.—GRIFFITH (*British Med. Jour.*, February 8, 1919) emphasizes the importance of a thorough training in obstetrics for medical students. He believes that gynecology is so intimately bound up with obstetrics that the subjects cannot be separated in teaching. He emphasizes the importance of preventive gynecology as distinguished from advanced and operative work. The obstetrical anatomy of the pelvis must be taught by the obstetrician, and this should be the gross anatomy which should be accurately given to the student. Physiology of the generative organs is also of great importance. Pregnancy, later the puerperal period and the pathology of obstetrics are the other subjects which should complete the course. Under pathology of labor he would include the treatment of obstetrical complications and only major operations, and also when the obstetrician must rely largely upon his own efforts. As regards methods of teaching, demonstration lectures, laboratory, museum and postmortem work, chemical work and teaching in wards and out-patient departments are the methods employed. The long and wearisome course of lectures which formerly was thought important is not considered the best method. Good lectures, well illustrated by personal experience, are of great value to advanced students who have already been grounded in the principles of the subject and have begun to obtain some experience of their own. Demonstration lectures, well illustrated with quizzes, are excellent. It is suggested that men on the back rows of benches be quizzed whose modesty or fear of quizzing has led them to take a back seat. Lectures and quizzes are better than text-books, for they give the lecturer the opportunity of emphasizing and repeating points of fundamental importance and illustrating them from his own experience. The obstetrical anatomy of the pelvis and its contents, menstruation, the anatomy of pregnancy, labor and the puerperal period and the mechanism of labor, can all be taught to advantage in this way. The mechanism of labor should be taught with the fetus and not with the fetal skull only. The writer states that he does not know of any mannikin which is sufficiently flexible. The remaining subjects should be taught by demonstration lectures, accom-

panying clinical work in the wards and out-patient rooms. Out-patient obstetrical work should embrace the attendance of students on patients in their own homes and the attendance by pregnant women in the out-patient department of the hospital. The first is of value to the students, not only from the purely obstetric experience, but also from the knowledge which it gives of the domestic affairs and troubles which patients may have and in which the physician may do much to render assistance. The student should be held personally responsible for the history and examination of the patients. He should pay especial attention to obstetric diagnosis, including the condition of the breasts, and he will examine the patient for evidences of infection. He should be especially impressed with the value of a systematic examination of all women in advanced pregnancy. In some instances there is advantage in teaching at the bedside and in the delivery rooms mixed classes of students and postgraduates, together with midwives and nurses. In this way the students saw how little they knew of nursing and the nurses were impressed with the difference between their own instruction and that given to physicians.

Postmortem Cesarean Section Following Death from Bronchopneumonia and Influenza.—HEPPNER (*Jour. Am. Med. Assn.*, March 8, 1919) reports the case of a patient admitted to the hospital in the third labor. She was moribund, markedly cyanotic and profoundly toxic. She had been sick for six days before coming to the hospital and had a moderate bilateral basal bronchopneumonia. The fundus was 3 cm. above the umbilicus. The fetal heart sound was easily heard and about normal in rate. Permission could not be obtained for delivery by section, so it was determined to perform postmortem section at the moment of death. Between three and four hours after delivery the woman died. Fetal heart sounds were becoming less audible and for the last fifteen minutes were so feeble they could not be heard with a stethoscope. As soon as it was certain that death had occurred section was done. The child was found to be toxic and feeble, but was easily resuscitated and cried. It weighed over three pounds and five ounces, and was not at the full term. The child survived for twenty-five days, then dying of croupous pneumonia, with pleurisy. Microscopic examination of the child's lungs showed many alevoli with fibrin and foci of round-celled infiltration in the smaller bronchioles. These were areas of necrosis. There was an inflammatory deposit on the pleuræ. The time elapsing after the mother's death before the birth of the child was one and a half minutes.

The Heart of the Pregnant Woman.—BURCKHARDT (*Am. Jour. Obst.*, December, 1918) calls attention to the importance of taking a very minute history in cases of pregnancy. When foci of infection are found the physician should be especially careful in examining a pregnant patient, that he may not overlook some serious condition of the heart. In the toxemia of pregnancy, pathological conditions of the heart muscle are not infrequent, and at times valvular lesions may also develop. The pregnant patients who have abnormality of the thyroid, disturbances in the circulation are very common. It is of great importance in the case of a pregnant woman having abnormal heart condition

that compensation should be maintained. A careful general examination of the patient is necessary to determine whether this is present or absent. Low blood-pressure is of importance as indicating the possible failure in the action of the heart. In pregnant patients whose compensation is failing and when a well-defined heart lesion is present a very strict hygiene should be maintained. The least sense of fatigue is to be avoided, and if the patient cannot take exercise she should have massage until outdoor exercise can be maintained. Blood-pressure readings are of considerable value in determining the condition of the patient. Offending tonsils or teeth should be removed and the pregnant condition of the patient is no contra-indication.

GYNECOLOGY

UNDER THE CHARGE OF

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Comparative Physiology of the Corpus Luteum.—In recent years some very interesting facts have been observed by veterinarians on the influence of the corpus luteum on sterility and abortion in the cow, and it has occurred to OCHSNER (*Illinois Med. Jour.*, 1919, XXXV, 225) that this data might be of great value in solving some of the similar problems in the human female. It has been observed, for instance, that if a false corpus luteum remains unabsorbed in either ovary of a cow she does not come in heat, a condition which corresponds to amenorrhea in woman, and so long as the cow does not come in heat she, of course, remains sterile. On the other hand, as soon as the false corpus luteum is absorbed normally or is expressed manually by the operating hand of the veterinarian the phenomenon known as heat develops within twenty-four hours. This observation has been made so many times by a sufficient number of highly trained, experienced veterinarians that in the minds of the veterinary fraternity it is no longer a debatable question. The author has had a number of patients with premature menopause who gave the history of having suddenly stopped menstruating because of a severe chilling during a menstrual period and who have never menstruated since, and another considerable number of patients who, following a severe chilling or illness during a menstrual period, menstruated only at intervals varying from several months to several years, who have had the distressing symptoms of artificial menopause, whom he today would laparotomize, carefully examine the ovaries of, and if an unabsorbed corpus luteum were found excise the same, with the hope of relieving their symptoms, reëstablishing men-

struation and curing their sterility. Veterinary surgeons have also made another very important discovery: Sometimes in expressing what they consider a false corpus luteum they have actually expressed or ruptured a true corpus luteum, in which instance one of two things has invariably happened: either the cow has bled to death in a very short time or she has aborted within from twenty-four to thirty-six hours. This observation on the cow throws very interesting light on two somewhat obscure problems in gynecological surgery, namely, the problem of abortion and the frequent finding of blood in the peritoneal cavity, which so frequently has been ascribed to ruptured extra-uterine pregnancy, but in which on careful examination no placental tissue has been found microscopically. The experience of veterinary surgeons, as well as Ochsner's experience in operating on pregnant women, leads him to believe that abortions following abdominal trauma are caused by injuries to the true corpus luteum and not to traumatism of the uterus itself, and that in operating upon pregnant women the important precaution is to avoid traumatism of the ovary containing the true corpus luteum if one wishes to avoid interruption of pregnancy. He has operated on a goodly number of pregnant women in almost every stage of pregnancy for a variety of abdominal conditions, such as intestinal obstruction, hernia, appendicitis, gall-stones and even fibroids of the uterus, without ever having caused an abortion, and he believes that this has been possible because he has always been very gentle with the ovaries at the time of such operations, not because he has known the fact that injury of the true corpus luteum would produce abortion, but because he has made it an invariable rule to treat all intra-abdominal organs with the greatest care and consideration.

The Action of Viburnum Prunifolium.—A review of the old clinical literature regarding the drugs efficient in the prevention of threatened abortion would lead the reader to believe that in the preparations of viburnum prunifolium there is available an unfailing remedy, one which quiets the uterus if that organ is stimulated to an abnormal degree of activity at an inopportune moment. The study of the action of certain proprietary remedies, one of the active principles of which was supposed to be derived from viburnum prunifolium, led HAGER and BECHT (*Jour. Pharm. and Exper. Ther.*, 1919, xiii, 61) to test the action of the latter drug also. The results of this investigation indicate that the effect produced on the uterus by alcoholic extracts and decoctions of viburnum bark are of little consequence in modifying the nature of the uterine activity, no uniform pharmacological effect can be ascribed to the drug, for while a stimulation may seem evident at one time a similar dose under the same conditions produces an apparent inhibition or no perceptible change whatever. As compared with drugs known to have a specific action on the uterine contractions, such as pilocarpin and pituitary extract in case of pregnant uterus the effect is negligible. The change in the contractions of the uterus which sometimes occur on the addition of an extract of the viburnum bark are so slight that the changes may be explained as having been produced reflexly through manipulations of the animal during injection or by the alcohol which holds the drug in solution. It is quite evident that the uterus of animals rendered unconscious by high section responds

to the intravenous injection of alcohol and a temporary inhibition or stimulation of the uterus is produced. As far as can be ascertained from the use of laboratory animals, no specific action on the uterus can be ascribed to preparations of the bark of viburnum prunifolium.

Factors of Safety in Hysterectomy.—In a series of 551 operations for hysterectomy performed by GUTHRIE (*Jour. Indiana State Med. Assn.*, 1919, xii, 71) there were 8 deaths, a mortality of 1.4 per cent. In this series there were 374 supravaginal operations, 63 panhysterectomies and 63 vaginal hysterectomies, and the particularly good results that have been attained have been attributed to three points in technic. In the first place, the author believes in the omission of the usual preoperative purging which is so commonly used in the preparation of patients. Such purging causes a dehydration of the patient and adds materially to the production of postoperative shock, and he believes that by merely giving the patient an enema much better results will be obtained. Another point that he has frequently mentioned in the past is the use of the Trendelenburg position, not only during the operation but while the patient is being put under the influence of the anesthetic. By the use of this procedure it has been found that by the time the operator has opened the peritoneal cavity the intestines will have gravitated out of the pelvis of their own accord and will not require the usual amount of handling in being "packed off." By thus eliminating a large amount of manipulation of the intestine, another cause of shock as well as postoperative ileus is removed. Finally, morphin is used freely in the postoperative treatment of these cases, and by thus keeping the patients in comparative comfort the psychic as well as the pain factor in the production of shock is eliminated. The observance of such apparently small points in technic are indeed of great importance and mark the difference between the real surgeon and the ordinary operator. There are many operators who are good technicians so far as the actual operating is concerned, but whose results suffer by comparison with the work of others merely because they have failed to observe these finer points in technic.

Roentgenographic Diagnosis in Renal Tuberculosis.—The roentgenographic data in renal tuberculosis are regarded of such importance at the Mayo Clinic that, according to BRAASCH and OLSON (*Surg., Gynec. and Obst.*, 1919, xxviii, 555), it is a rule to make a complete roentgenographic examination of the urinary tract in every case in which renal tuberculosis is suspected. The frequency with which positive data may be obtained in the roentgenogram is evidenced by the fact that in the years 1916 and 1917, 131 patients were operated upon for renal tuberculosis, and roentgenographic examination of the urinary tract had been made in all. Of this number, positive shadows suggestive of urinary tuberculosis were found in 30 patients, a percentage of 22. It may be stated, therefore, that approximately 1 out of 5 patients with renal tuberculosis will have positive roentgenographic data of definite diagnostic value. Such data are of particular diagnostic value when, because of the contracted condition of the bladder or impassable stricture of the ureter, the cystoscopic findings are

inadequate or when the cystoscopic findings are not typical of renal tuberculosis. Furthermore, they are of special value when the clinical findings are not suggestive of renal tuberculosis or of any involvement of the urinary tract, as may occur with a closed tuberculous pyonephrosis. The roentgenographic shadows are caused by the deposit of calcium in the tuberculous area and may assume a variety of forms. To one who has had considerable experience in roentgenographic interpretation such shadows will have characteristics that are usually recognized and may be differentiated from a stone shadow by (1) the variability in its density, as the shadow is irregularly concentrated in its different portions; (2) by a shadow of lesser density throughout than that usually observed with stone; and (3) by its irregular and indefinite outline. The calcareous area may, however, simulate the shadow of a renal stone in every particular, and it may be quite impossible to differentiate it without further clinical data. The same is true of renal stones that are occasionally seen of such consistency that the shadow will be fully as irregular and hazy in outline as a typical tuberculous shadow. It may be said, however, that approximately 75 per cent. of tuberculous renal shadows may be recognized as such in the roentgenogram.

Prolapse of Uterus in a Young Virgin.—To most practitioners the the subject of uterine prolapse probably calls to mind a middle-aged woman, who has had many children or very difficult labors, with severe lacerations of the pelvic floor. It may be of interest, therefore, to refresh our memory on this subject and recall that occasionally uterine prolapse occurs in a virgin usually after the age of thirty. The case reported by MOORHEAD (*Surgical Clinics of Chicago*, April, 1919, p. 407) is of unusual interest, in that it occurred in a virgin who was only eighteen years old. When she presented herself for treatment she gave the usual history of a swelling at the vulva which had been present for one year, aggravated by exertion, and which disappeared when she was recumbent. There was nothing in her history to indicate the cause of this condition aside from the fact that she had been forced to do very hard and laborious work since she was twelve years old. The prolapse was a complete one, the uterus extending two inches outside of the vaginal outlet, drawing the anterior vaginal wall with it, although the posterior wall was only slightly involved. In the treatment of this case the author performed a high amputation of the cervix, shortened the uterosacral ligaments by plication and shortened the round ligaments by the Gilliam technic. The usual explanation of these cases of prolapse of the uterus in virgins is that there is a congenital weakness of the uterine supporting structures, especially the uterosacral ligaments and the connective-tissue structures in the bases of the broad ligaments, frequently called the cardinal ligaments. Naturally these structures must give way before a prolapse can occur, but whether they are congenitally weak or are weakened by an unusual amount of strain, as the author believes to have been the case with his patient, is a point that will have to remain debatable.

OPHTHALMOLOGY

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Etiology and Prophylaxis of Scrofulous Affections of the Eye.—STEINER (*Ann. d'ocul.*, April, 1919, p. 228), who has practised for many years in the island of Java, writes that the rarity of scrofulous affections of the eye and of scrofula in general is very striking in that country. He believes the cause of such immunity to be due to the fact that the people of the island, dwelling as they do, in a tropical climate of continuous warmth, are much more scantily attired than the inhabitants of Europe and their bodies exposed to the sun's rays. The same conclusion is suggested by the good results which have been obtained in Europe in these affections by the so-called "sun cures;" it is also supported by the successful results from other methods of treatment in use for a longer or shorter period of time, which have this in common that they act upon the skin by stimulation (artificial light, salt baths, sea bathing, Kapesser's treatment by friction with black soap). He recommends giving the youth of Europe the benefit of the quasi immunity of the Javanese by greater exposure of the person to the sun's rays and reforming the dress. He recommends for children during the warm season a garment light in weight and light in color, leaving exposed the arms, legs, part of the breast and back, no stockings and sandals in place of shoes. He calls attention to the fact that in Java pulmonary phthisis is extremely severe, while tuberculosis of the bones is rather rare. Treatment by exposure to the sun's rays is very efficacious in the latter, while the former appears to be refractory to it, a circumstance which he thinks tends to support his views.

Diagnostic Value of the Ocular Syndrome of Hypertension in Wounds of the Cranium, Including Trephining.—TERRIEN (*Arch. d'ophtal.*, July–August, 1918, p. 255) studies, following wounds of the cranium, a peculiar ocular syndrome, particularly interesting in that it frequently occurs alone to the exclusion of any other general syndrome, while the vision itself may remain normal. The syndrome is characterized by the following triad of symptoms: attacks of diplopia, narrowing of the visual field and papillary stasis, the latter being much the more common. He finds as the result of observation in 20 cases that the stasis is ordinately very moderate and not generally accompanied by any diminution of the visual acuity; its sole subjective symptom being transitory obscurations of short duration. Cantonnet, in 1915, and Dantrelle, in 1916, have reported quite a number of similar observations. As regards the attacks of diplopia the latter is

homonymous and due to compression of the external oculomotor nerves. The pathogeny seems identical with the double vision of intoxication, transitory intercranial hypertension. The narrowing of the visual field and enlargement of the blind spot are quite marked, but never sufficient to disquiet the patient, who, in fact, has no suspicion of their presence. All these disturbances disappear under lumbar puncture; they deserve to be sought for inasmuch as they may readily pass unperceived, and may lead to the discovery of an unrecognized cerebral lesion.

Diffraction in the Human Eye and the Phenomena of Colored Rings Surrounding Luminous Sources.—SHEARD (*Am. Jour. Ophth.*, March, 1919, p. 185) notes the universality of colored rings and coronæ surrounding luminous sources under fairly favorable conditions of observation. These rings are due to the diffraction of light by the constituent parts of one (or more) of the ocular media. The first, which is commonly the only one seen, is due to diffraction of the cells of the anterior epithelial layer of the cornea or possibly to the endothelium of Descemet's membrane (Druault). The second ring is evidently due to diffraction by particles of a smaller size than those which produce the first ring. The writer suggests the inner layers of the anterior epithelial portion of the cornea. This ring has been attributed by Druault to the lens fibers, but such a view is not tenable. The ciliary corona is due to the lens fibers and the striæ to the lens star.

Treatment of Keratoconus.—EPERSON (*Ann. d'ocul.*, April, 1919, p. 226) discusses correction of keratoconus by Müller's shells. The ophthalmometric measurements show that the refraction of these shells when applied to the cornea by the interposition of gelatin or some similar substance is several diopters less than of the same measurements upon the bare cornea, due to the fact that the posterior surface of the shells is more strongly curved than the anterior, so that the shell acts like a divergent meniscus. He has constructed an artificial eye with Müller's shells taking the place of the cornea and thus has been able to measure directly by skiascopy their total refractive power. In this way he has been able to show that the shells are frequently astigmatic, particularly oblique and also a conical deformity which affects at least a quarter of the surface. Müller's shells are better tolerated than Sulzer's contact glasses, and much more serviceable from the optical standpoint, although it is very desirable that the shells be improved from the latter point of view. It is possible to correct by means of the shells not only keratoconus and irregular astigmatism but also high myopia (by weakly refracting shells) and aphakia (by shells of strong curvature).

Tuberculin in the Diagnosis and Treatment of Eye Diseases.—TÖRÖK (*Arch. Ophth.*, May, 1919, p. 242) in a discussion of this subject comes to the following conclusions: For diagnosis and therapeutic purposes in eye conditions only the subcutaneous injection of fresh solutions of tuberculin is of value; it can be used in children as well as in adults, with practically no danger. An eye condition is to be considered tubercular only when a positive focal reaction has been

observed. When such cannot be obtained but a positive general and local reaction is present, and every other possible cause for the eye condition is with reasonable certainty excluded, the case may be considered to be of probably tuberculous origin. The treatment should begin with a very small dose, $\frac{1}{10000}$ mgm. and increased to the maximum of toleration; it should never exceed 1 mgm. The duration of treatment must be long continued, even for several years. Tuberculin is of least value in chronic uveitis cases, with the exception of heterochromic cyclitis; it is most satisfactory in scleritis and periphlebitis retinæ. Scleritis, deep and interstitial keratitis and iridocyclitis are closely related to each other and may change from one condition to the other. Exudative choroiditis is seldom of tubercular origin; the teeth are often the source of infection in these cases.

Syphilis and Irregularity of the Pupil.—DUJARDIN and RASQUIN (*Ann. d'ocul.*, February, 1919, p. 89) by the term irregularity of the pupil qualify any angulation of the circumference of the same. Normally the pupil is quite circular or at most slightly oval, with the long axis sensibly vertical. The pupil should be examined for irregularity both by natural and artificial light. As a result of their studies they find that irregularity of the pupil is an extremely frequent symptom in the course of syphilis, especially from the secondary stage onward, and the more frequent with the lapse of time; in fact, such irregularity may be the sole pupillary symptom in advanced syphilis. Irregularity of the pupil is probably syphilitic in 70 per cent. of all such instances, so that every case of "essential" irregularity should be examined serologically and even by lumbar puncture.

PATHOLOGY AND BACTERIOLOGY

UNDER THE CHARGE OF

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The Clinical Value of Complement Fixation in Pulmonary Tuberculosis Based on a Study of 540 Cases.—One of the most difficult problems for the clinician after a diagnosis of tuberculosis has been made is the determination of the presence or absence of activity. The definition of "activity" will always arouse debate and in this case the authors adopted hard and fast rules for the determination of active tuberculosis. The subcutaneous tuberculin test was used for a time as a most reliable diagnostic test for early clinical tuberculosis, but it has since been found not applicable in febrile and hemorrhagic cases, diabetes, nephritis, cardiac involvements and in pregnant women. The complement-fixation test is now being used in many sanatoriums and offers valuable aid to the clinician. BROWN and PETROFF (*Am. Rev. Tuberc.*, 1918, ii, 525) record their experience with the test made

on 540 cases which may be divided into three usual groups: incipient, moderately advanced and far advanced. They used a glycerin antigen of the tubercle bacillus which gave the best results though not a 100 per cent. positive reaction. No antigen yet discovered produces perfect results. The authors found that a positive complement fixation indicates that antibody is or has recently been circulating in the blood stream. The far-advanced cases react positively more frequently to the test than the moderately advanced and the moderately advanced than the incipient. Only one combination of clinical data will predict fairly close (95 per cent.) the presence of a positive complement-fixation test. This test is more likely to be positive when tubercle bacilli have been found in the sputum and when hemoptysis without tubercle bacilli has occurred. About 10 per cent. of the patients having tubercle in the sputum react negatively to the test. The intradermic tuberculin reaction and the subcutaneous tuberculin test do not run parallel with the complement-fixation test. The former are in most cases more persistent but occasionally patients will react positively to the complement-fixation text and negatively to the subcutaneous tuberculin test. Various factors will interfere with the test; for example, patients with pleurisy with effusion do not react readily to the complement-fixation test. The authors feel that this test is of value to the clinician and like the subcutaneous tuberculin reaction is of more value when it is negative than when positive in the determination of which patients used treatment.

Attempts to Reduce the Resistance of the Guinea-pig to Tuberculosis by Means of Various Agents.—It is often convenient in making a rapid diagnosis of tuberculosis by means of inoculation of the infected material into guinea-pigs to reduce the resistance of the animal and thus shorten the time of incubation from the usual five to seven weeks to eight or ten days. According to Morton, one massive dose of roentgen rays administered just before or after inoculation will lower the resistance sufficiently. But not every laboratory is equipped with a roentgen-ray machine so CORPER (*Am. Rev. Tubere.*, 1918, ii, 587) undertook a series of experiments, with a view to finding a substitute for the roentgen ray. He tested guinea-pigs with injections of various materials, a mixture of benzene and paraffin, thorium X, tuberculin and ether by inhalation. It was found that neither a single large subcutaneous injection of benzene nor repeated small injections have any influence upon the course of macroscopic tuberculosis in the guinea-pig infected with human tubercle bacilli. Since benzene lends itself well for inhalation experiments and believing that a more profound effect of the benzene could be obtained a series of experiments was undertaken. They indicated that benzene administered to guinea-pigs by inhalation to the point of unconsciousness daily during a period of about a month, beginning inhalations at the time of infection or twelve days prior has no influence upon the course of tuberculosis as measured by the macroscopic anatomic involvement. Having failed to reduce the resistance of the guinea-pig to tuberculosis by means of benzene it was deemed advisable to repeat the investigations with the roentgen rays in animals given definite amounts of human tubercle bacilli and suitably controlled. The author's

experiments show that a single large exposure to the roentgen rays (Morton's method) or a single large one followed by a series of smaller exposures has no influence upon the progress of the macroscopic anatomic tuberculosis in the guinea-pig even though this produces a temporary leukopenia as low as 2000 leukocytes per cubic millimeter. Experiments with thorium X given in amounts sufficient to maintain a marked leukopenia throughout the period of infection and tuberculin in large doses had no appreciable effect upon the course of human tuberculosis in the guinea-pig. Nor did ether by inhalation to the point of light anesthesia for a long period of time increase the susceptibility of the animals.

Hypertrophy of the Adrenal and Retention of Adrenalin in Infections, Intoxications and Certain Immune States.—Hypertrophy of the adrenals in intoxication is classic even since the works of Caussade and ever since the discovery of adrenalin the medulla of the adrenal has been studied to determine the effect of an increase or diminution in the amount of adrenalin in producing certain pathological states. The arterial hypotension in toxic infections or in intoxications has been attributed to a diminution in the secretion of the medulla of the adrenal. In fact, adrenalin, after the teaching of physiologists, ought to maintain the activity of the sympathetic system and the cardiovascular tonicity. This conception, which was classic and has been applied most often, has been denied by Gley and his collaborator, Quinquand. Porak (*Jour. de phys. et de path. gén.*, 1919, xviii, 95) performed a series of experiments to study the arterial pressure and retention of adrenalin by the adrenals in different infections and intoxications. The author noted also the variations in the weight of the adrenals at different stages of the infections and intoxications and compared the weight with that of the body. Of the normal animals studied the author used monkeys, rabbits, guinea-pigs, rats and man. Of infections he used rabies in a rabbit, tetanus in a guinea-pig and rabbit, poliomyelitis in a monkey, diphtheria in a guinea-pig and a rabbit, pneumococcus in a rat and various other infections in man and animals. Experimental tuberculosis, purulent pleurisy in a rabbit and three infant cadavers, one a case of tuberculosis and two of bronchopneumonia. Of intoxications, he studied typhoid fever in a man, intoxications in guinea-pigs by mercury, lead, strychnin, chloroform and various types of endogenous poisons. The author is able to report that the relation of the weight of the adrenals to the weight of the body and the retention of adrenalin by the adrenals do not confirm the importance of the insufficiency of the medulla of the adrenal in infectious diseases. Anatomic pathology teaches that the adrenals can be the seat of hemorrhages or of bacterial infections and chronic lesions (scleroses and caseous degeneration). In these cases there exists perhaps a certain degree of glandular insufficiency, but the author completely ignores the mechanism of this insufficiency. The author's purpose was to prove that the adrenals do not interfere by their angiotonic function in infection and intoxications, for there is no relation between the retention of adrenalin by the adrenals and the level of the arterial pressure. Although adrenalin has ceased to play a part as a vascular hormone in infections and intoxications, it is not necessary to attribute it to the

uselessness of the adrenals. It has been found that as the weight of the body decreases in disease processes the weight of the adrenals increases. An increase of weight without congestion of the organ is very significant. The increased weight is not due to an accumulation of adrenalin; it can proceed, for example, from an increase in the retention of water or an abundance of cellular elements. The author does not think these modifications ought to be considered in the majority of cases, as the lesions produce a state of functional insufficiency. He believes that the organ reaches a state of more or less complete rest. The same occurs in pathological processes of most varied character, as the experiments in immunization against tetany and the incubation of rabies proved. When determining the diminution in the amount of adrenalin in the whole organ it is found most often in the hypertrophied portion, not in the medulla but in the cortex. In a further paper the author expects to review in detail the importance of the cortex of the gland.

The Quantity of Circulating Blood Measured by the Number of Red Blood Cells.—There are only two methods commonly employed in measuring the quantity of circulating blood, that of Valentin (1838), since modified many times, and the classic method called the "de Welcker method." It is this latter that BRODIN, RICHET and SAINT GIRONS (*Jour. de phys. et de path. gén.*, 1919, xviii, 8) used in their experiments. The method consisted in anesthetizing the animals (dogs) and drawing blood in varying quantities from the carotid artery, jugular vein or less often the femoral vessels. The circulating system is then flushed with water and the total quantity of blood estimated by the number of red blood cells. There have always been several faults in this method, chiefly that by perfusion one cannot prevent the formation of small plugs in the arterioles and venules, so that the washing of the body does not give the total amount of blood contained in the body. Moreover, the use of water alters the cells so that they give off their hemoglobin which is diffused through the tissue. The authors modified this method in an effort to correct these faults. They used various solutions: sodium citrate, to prevent coagulation and a fluid which will not alter the red cells, so that there will be no diffusion of hemoglobin in the tissues and no coagulation in the smaller vessels. Their results show that the quantity of blood is very unstable, varying from 10 to 20 per cent. in several minutes. The mass of blood per kilogram is with dogs, in spite of great individual differences, in inverse proportion to the weight of the body. Since the body heat is maintained by the blood, and since radiation is dependent upon the surface rather than the weight of the animal, it was found that this mass of blood is proportional to the surface of the body and not to the weight. Further, that for a given unit of weight the surface of the body, the number of red blood cells and the quantity of blood are parallel. In general the greater the mass of blood per kilogram the higher the total number of red blood cells. When the blood mass is greater than 75 grams the number of red blood cells is 5,360,000, for a mass 71 to 75 grams 4,790,000, and for less than 60 grams 4,050,000. As a corollary of this law it was found that the mass does not vary with the percentage of cells and consequently not with the density of blood. For leukocytes,

on the contrary, the greater the percentage the less the mass of blood. Lastly, the smallest amounts of blood compatible with the temporary survival of the animal are in the neighborhood of 25 per cent. of the initial mass, whereas the cells can drop to 5 per cent. of their original number. If the function of the cells is the carrying of oxygen the function of the mass is the giving off of CO_2 and assisting in the organic combustion of cells. Perhaps this diminution in the mass is associated with "acidosis" which has been observed after great traumatic hemorrhages, be it as cause or effect.

The Spirochete of Infectious Jaundice in House Rats in Chicago.—Since the discovery of the spirocheta icterohemorrhagica as the causative agent of infectious jaundice, different workers have found spirochetes answering its description in various numbers of rats and field mice in different parts of the world. Ido observed two cases of Weil's disease following rat bites. OTTERMAN (*Jour. Infect. Dis.*, 1919, xxiv, 485) examined various organs of 30 rats caught in Chicago and found spirochetes resembling the Spirocheta icterohemorrhagica in only 2. In one of these the spirochete was found in the mouth and in the other in the kidney. Emulsions of the kidneys of the rats caused the disease in no instance.

A Further Report upon Diphtheroid Infection of Wounds.—Adami, Bowman, Janes and others working in hospitals in England 1917–1918 investigated the occurrences of B. diphtheriæ and diphtheroid organisms in open wounds. Their examinations of 306 wounds showed 2 to be infected with diphtheria bacilli and 56 with diphtheroid organisms. This investigation was stimulated by that of Fitzgerald and Robertson, who, in September, 1917, had reported the presence of diphtheria bacilli in 40 out of 67 wounds examined. These examinations were made on soldiers returned to Canada from England. JANES and THOMAS (*Canadian Med. Jour.*, 1919, ix, 434) in a further examination of wounds in England showed diphtheroid bacilli in about 63.5 per cent. of 129 cases. Testing 30 of these diphtheroid organisms culturally and in guinea-pigs, 3 proved to be true Klebs-Loeffler bacilli. This latter figure would indicate about 6.4 per cent. of the wounds examined were infected with diphtheria bacilli. They found membranes in a number of wounds infected with diphtheroid bacilli as well as in those infected with diphtheria bacilli. The cultures were made on wounds of three to seven months' duration. Reports received so far of bacteriological examination of wounds in the U. S. Army do not show such a high percentage of true diphtheritic infections. These examinations, however, have been made of fresher wounds.

Effect of Bile on Clotting Time of Blood.—It is known that jaundice tends to cause an increase in the coagulation time of blood, but a satisfactory reason for this has not yet been given. HAESSLER and STEBBIN (*Jour. Exper. Med.*, 1919, xxix, 445) performed a series of experiments to determine whether or not bile or bile salts which are present in the blood in jaundice are in themselves capable of causing the increase in coagulation time. Cats under ether anesthesia were bled from a large artery and the whole blood and plasma tested with

varying concentrations of ox-bile solution. It was found that within certain limits clotting time depends on the percentage of bile present in solution. With amounts of bile greater than 5 per cent. there was a retardation of clotting great enough to be detected by clinical methods. When sodium glycocholate was substituted for bile the results were the same. The authors further studied to determine whether the bile salts prevented the formation of thrombin or merely interfered with the change of fibrinogen to fibrin, these two steps being generally conceded to take place in the process of coagulation. Solutions of fibrin and thrombin were prepared according to the method of Mellanby. They concluded that bile and bile salts do not interfere with the formation of thrombin, since the prolongation of clotting time is just as great when preformed thrombin is added in ample quantity to fibrinogen solution as when thrombin is formed from its precursors in the presence of bile. Hence they assume that it is the conversion of fibrinogen to fibrin that is interfered with rather than the formation of thrombin.

Agglutination of Streptococci.—Many workers have attempted to classify streptococci by means of agglutination, but the results have never been decisive enough to warrant practical application. NAKAYAMA (*Jour. Infect. Dis.*, 1919, xxix, 489) experimented with nine strains, four of which were from cases of scarlet fever the others from various sources. He found relatively high agglutinin production in immune rabbit serum from the homologous streptococci. There was no constancy in the production of agglutinins for heterologous strains. Among these agglutinins were high in some instances, absent in others. Some relation seemed to exist among three of the strains from cases of scarlet fever, as demonstrated by heterologous agglutination tests The production of minor agglutinins was lessened by treating the streptococci with cinnabar before injecting them into the rabbits for the production of the immune serum. He concludes that even with this treatment the results are not definite enough to separate the streptococci into distinct groups.

A Characteristic Localization of Bacillus Abortus in the Bovine Fetal Membranes.—The localization and multiplication of bacteria within cells not having phagocytic functions have thus far been demonstrated in leprosy, syphilis and in a disease of mice recently described by Tyzzer, who found an active invasion of both liver cells and intestinal epithelium by a bacillus. In cells to which phagocytic powers have been ascribed the specific localization of certain bacteria is well known. Thus, tubercle bacilli can be found in endothelial cells, leprosy bacilli in a variety of cell groups and the organisms of mouse septicemia occur regularly in certain phagocytic cells of the blood. Recently, bacteria have been found attached to the cilia of the respiratory tract in pertussis by Mallory and Hornor in a form of guinea-pig pneumonia. Sporozoa have often been found in epithelial cells, where they multiply and cause destruction of the cell. It is highly probable that bacteria set in a similar fashion. THEOBALD SMITH (*Jour. Exper. Med.*, 1919, xxix, 451), in studying diseased membranes in cases of infectious abortion of cattle, came upon a peculiar and characteristic habitat of B. abortus (Bang) in the epithelial covering of the chorion. He

thinks that the value of this finding cannot be fully estimated until a more complete history of the successive localizations of the bacillus has been obtained, but he feels it is safe to assume that this is the earliest stage in which the organism gains by rapid unchecked multiplication a considerable advantage over the host. The local destruction of an epithelial covering by an infectious agent when other miscellaneous infectious agents are absent may or may not be of much importance, for it would depend on the regenerative activity of the epithelium, the tendency to the gathering of injuries transudates and the toxic substances associated with the bacilli. The author found that localizations of B. abortus also occur in the walls of the bloodvessels of the chorion. Thus far he has observed only one case of this kind in which the connective-tissue cells of the adventitia of a vessel 0.8 mm. in diameter were completely replaced by clumps of minute bacilli. Since there is usually a slight perivascular infiltration in the diseased placenta this localization may be largely responsible for the circulatory disturbance which lead to the death of the fetus. The case referred to may be but a greatly exaggerated illustration of the action of B. abortus in the walls of the bloodvessels where they are too few in number at any one time to be identified.

The Organisms of Secondary Infection, Especially Pneumococci and Streptococci, in Pulmonary Tuberculosis.—Cooper, Donald and Antz (*Jour. Infect. Dis.*, 1919, xxiv, 498) cultured the blood of 216 cases of pulmonary tuberculosis, of which 36 were far advanced, and found hematogenous infection in 7 of the cases. Four of these, however, were staphylococci, and the authors indicate they were probably skin contaminations. Of the others 1 was Micrococcus tetragenus, 1 pneumococcus type II and 1 pneumococcus type IV, with a streptococcus. These results were obtained in broth cultures. All blood cultures in solid media were negative. The case with pneumococcus II was febrile and the case with pneumococcus IV associated with the streptococcus was afebrile. Both of these positive cultures were in far-advanced cases. The occurrence of pneumococci and streptococci in the blood, as found by these authors, is rather low in view of the findings of Pettit and those of Brown, Heise and Petroff. Of 8 cases which died only 1 yielded a positive blood culture postmortem, pneumococcus type II. This case was negative when examined one week before death. The case in which Micrococcus tetragenus was found was moderately advanced. Thirty per cent. of the sputa of the 216 cases revealed pathogenic pneumococci and streptococci.

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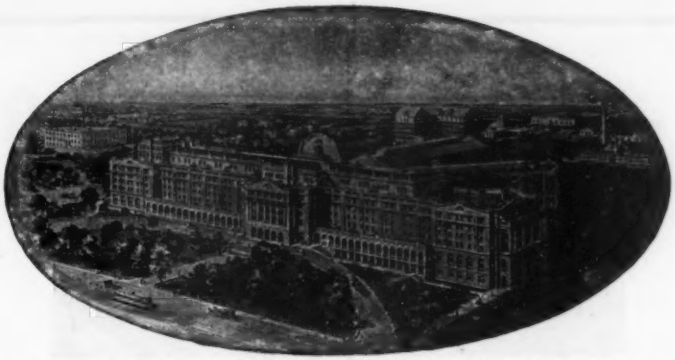

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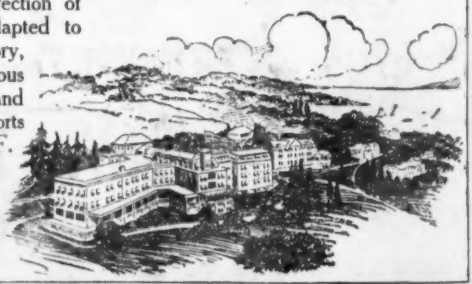

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